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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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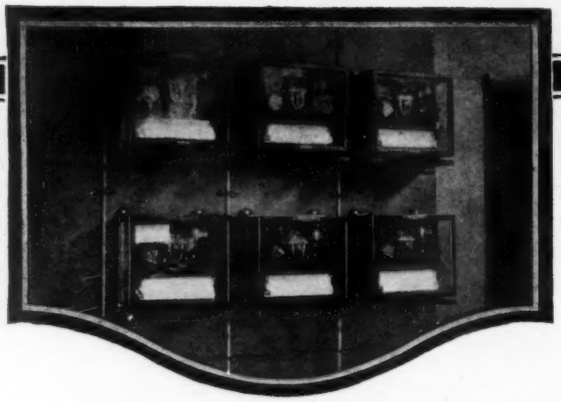
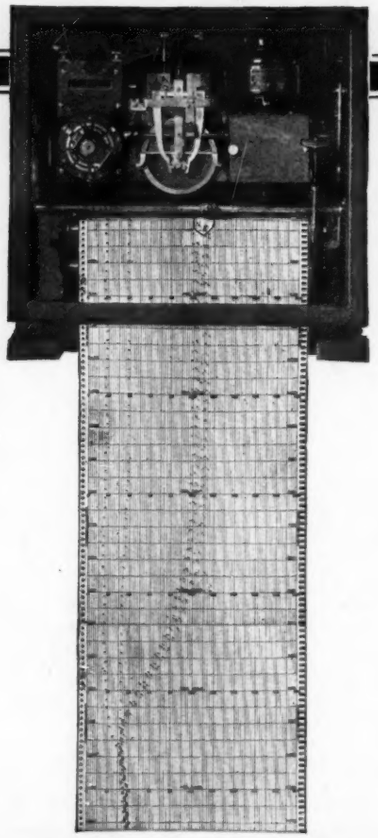
Alabama Power Company

Automatic Alarms Protect Generator Windings





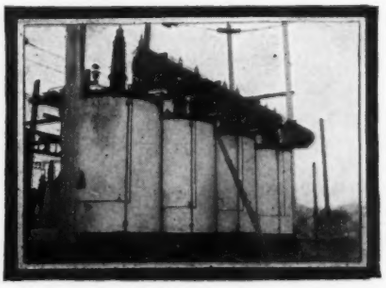
Six L & N Multiple Point Recorders for generator and transformer temperatures on central switchboard at Mitchell Dam Plant of the Alabama Power Compar.y

RECORDING instruments are almost always to be desired over those that merely measure and do not record. The recorder chart, providing a history of what has occurred, is of permanent value to managing officials. It helps the operator also by telling him not only exact temperatures, but the direction and rate of change in temperatures.

Huntsville Substation

L & N equipment records transformer temperatures at the Huntsville, Alabama, plant of Alabama Power Company. See illustration at right.

Bulletin No. W-871 treats the subject of generator and transformer temperature measurements in a way that has proved to be especially interesting to power plant engineers.



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Electrical World

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Editor

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The Half Year to Come

THE second half of the year should by all indications establish a new record for the electric light and power industry. There will be no doubt of the outcome if executives live up to their promise of greater commercial activity. But even apathy in high places cannot keep away load which naturally gravitates to the lines of electric light and power companies, and that business is constantly increasing. A little energy and a trifle more faith would send it rocketing.

The first half of the year, for example, while it showed nothing startling industrially and while financially it witnessed great depression in stock values, revealed for the electric public utilities of the country a 12 per cent increase in output and a 13 per cent increase in income over the similar half of 1925. During that period executives did not bestir themselves greatly, bewailing rather the drop in the market value of securities. More attention to the commercial details and possibilities of the business would have been more profitable, because "He that observeth the wind shall not sow and he that regardeth the clouds shall not reap." If the precept implied in this homely saying shall be followed this fall, executives will find that business and stock quotations "shall be alike good."

A.I.E.E. Convention Affords Proof of Engineering Competency

EXCEEDINGLY well worth while was the annual convention of the American Institute of Electrical Engineers, held at White Sulphur Springs, West Va., last week. The executives of the Institute stressed the importance of engineering participation in all national affairs. The technical committees made reports which showed the status of the art and outlined the developments needed. Several fine technical papers were presented which gave rise to profitable discussions. The meeting, in short, gave evidence of entire competency on the part of electrical engineers to meet their responsibilities.

The subject of standards received an unusual amount of attention, and it is interesting to note that the American Engineering Standards Committee and the embryonic International Standards Association owe their formation to the fact that electrical engineers had shown by their own organizations that standards could be made and were needed. The A.I.E.E. standards committee and the International Electrotechnical Commission can well be proud that they were the originators of standardizing agencies of still broader scope.

Surveyed as a whole, the art of electrical engineering is well in hand and yet has very great possibilities for development. The address of Dr. Pupin showed the great tasks still to be done before electrical engineers can rest content. Yet a perspective view of this convention gives rise to the conviction that under the banner of the Institute electrical engineers will conquer all difficulties.

Solving Rural Problems Through Existing Customers

WITH the work so far accomplished by the twenty state co-operative projects studying the relation of electricity to agriculture, and with the questions of financing and rate structure very well answered, for the time being at least, by Wisconsin, New York and Iowa, it appears that central-station companies which do not serve experimental lines might well undertake to apply the same principles of investigation to a few of the farms they already serve. Ten or twelve well-separated farm customers who are typical of the community served can be profitably made the subjects of study by one or more representatives of the local power company. Such investigators might well devote their entire time to the work and ascertain the applicability of power to different farm processes, devising or suggesting to manufacturers suitable transmission mechanisms for connecting motors and farm equipment, keeping records and so forth.

Just as the state-project experimental lines have been a means of educating the nearby and visiting farmers to greater use of electricity, so will concentration of utilities on a few well-distributed farm customers be a stimulus to development of consumption by other farmers in the territory. What is needed is greater use of electricity on the farm. Every farmer and every farmer's wife on an experimental line who are convinced of the value of electricity will be indirect sellers of this idea to neighboring and visiting farmers. Furthermore, the farmers will in this way be shown that a real effort is being made to solve the problems of service.

So far it appears that the farm-line voltage should certainly not be less than 6,600, that the service transformers should be in the center of the farm load, that the place to start is in building the house consumption, that individual-process demands should be reduced to the minimum and that the attachment of motors to farm equipment should be made as simple as possible. Processes demanding large motors will probably be served best by portable instruments rented from the community, a co-operative association or the central-station company. Such motors can be kept in use a large part of the time. Large energy-consuming applications should not be sought alone, as devices of small consumption which render a greater service, economy or convenience will often be found the means of justifying other applications.

After giving farmers a chance to experience the benefits of electric service, it will not be hard to show

them that they can have most of these benefits with no more yearly expense than an average-price automobile entails. Convince the farmers first of the convenience, comfort and higher standard of living that electricity brings; then emphasize its economies. Where necessary it may be advisable to extend to farmers the time-payment privilege on electrical equipment. Utilizing farm labor as much as possible in line construction will provide some farmers with money to spend on electrical equipment. It should hardly need emphasizing that individual company investigations should be conducted in closest co-operation with the state project leader and the National Committee on Relation of Electricity to Agriculture.

The Coming Joint Conference on Wiring Trends

THE announcement of the proposed joint conference on the trend of wiring is being read this week with general interest throughout the industry. The fact that it comes at the invitation of the Association of Electragists and the National Electric Light Association and is to be participated in by the Electrical Manufacturers' Council and the Electrical Supply Jobbers' Association makes the call official. The delegations which will represent these associations, it is understood, will be men of outstanding prominence, and the expectation is that there will be a frank, earnest effort to find and publish the truth as to the comparative cost of different systems of wiring now in use and their influence on the trend of wiring.

An opportunity exists for a constructive contribution to the general wiring situation. In the past there has been too much opinion and too little fact on which to base judgment on the various controversial issues that have revolved about the subject of wiring, and if this conference constitutes itself as a fact-finding body and fearlessly presents a full picture of conditions as they are, much good should come of it. If, on the other hand, it should permit itself to indulge in opinions or advocate one method of wiring against another, it will but confound confusion. There should be but one opinion in the conference as between products, and that is that any wiring material approved as safe under the code should be left free to seek its economic level in the market, without restriction and without subsidy.

A Key to Easier Power-Plant Maintenance

HIGH fuel economy, desirable as it is, is not the only objective of the engineer responsible for delivering energy to the bus at minimum unit cost. Closer team play between designing and operating engineers in relation to efficient plant handling, which includes the important subject of maintenance among many others, is also an important factor. Scrutiny of station designs as affecting maintenance will reveal the advantages of intimate relations between the drafting board and the tool kit in the interest of making inspection and repair jobs easier and therefore quicker and less costly in money expended and through time saved in caring for equipment.

The pass key to easier maintenance is accessibility, and thought should be given to avoiding awkward locations of apparatus, especially auxiliary motors and control equipment functioning in remote corners of the station. Putting a coal-bunker monitor window opening mechanism on the wrong side of a column, employing unnecessarily complex control outfits on ash-hoist motors, trying to get along with industrial ash trucks whose motors are barred from ready inspection and brush replacement by the design of the truck framing, cramping relays into crowded basement locations and providing insufficient head room above oil circuit breakers are typical conditions which make maintenance work difficult, to say nothing of inadequate stairway and walkway provision in boiler houses and around piping. Remote-controlled steam piping valves should have accessible motors, and greater consideration of emergency lighting from storage batteries is desirable. This sort of engineering does not demand that equipment shall be so provided with bolted covers and locking levers that "a mere child can open it"; but operating men whose daily task it is to come to grips with maintenance problems have a right to expect ample space to work in and to be able to use heavy wrenches and portable chain hoists with reasonable freedom of movement.

Accessible equipment also reduces the personal accident hazard often introduced because of the poor location of apparatus. Many comparatively old plants can be thus improved at moderate cost and the subject of accessibility should receive joint consideration of designers and operating men in both old and new installations.

Salaries Versus Commissions for Power Salesmen

A REVIVIFIED commercial spirit is activating all utility companies. "More business" is the watchword. Every one recognizes that more business is to be had, but how to stimulate salesmen to get it is a problem with companies which want to adhere to old methods and schedules of compensation. Even where this desire does not exist, the heads of commercial departments, before laying the blame entirely on the present method of compensation, will ask themselves whether they have adequately classified their markets as to desirability and promise and whether they have sufficiently studied the buying habits, channels of approach and appeals necessary. Adequate answers to these questions involve surveys and compilation of data on economic experience that will be convincing to prospective customers.

With these essentials secured, the next question is, "Have the proper sales organization and methods of functioning been developed?" This involves the right type of human material—salespeople by inclination and desire—fitting the individuals to the work they like, proper allocation and co-ordination of activities, periodic conferences on experience, vision, leadership, executive recognition and support. Without this background changes in methods of compensating salesmen alone cannot produce the desired results. On the other hand, improper compensation of salesmen will sacrifice most of the benefits obtainable in the ways just sketched. To profit by these assets requires the combination of harmonious working conditions and a basis of com-

pensation that will attract salesmen of the proper caliber and permit them to grow. Any conditions which cause a rapid turnover in personnel are costly.

From the executive viewpoint, the specific form of compensation should be of no interest so long as it procures business at a low unit cost and improves relations with customers. Looked at in another way, whatever produces the best permanent results at the lowest unit cost is the best method. If a yardstick of sales ability could be obtained which would take into consideration the ease of obtaining different classes of business and the time spent in servicing, giving advice and keeping customers friendly, perhaps a commission basis of payment would have no objectionable features. However, there is no incentive in any known commission schedules for a salesman to give a customer any attention after he has once closed a contract. No method of penalizing commission salesmen for improper selling or for inattention to customers after signing the contract is known. A combination salary-and-commission plan possesses some of the advantages of a straight commission but retains many of the objections.

In many ways it appears that a straight-salary schedule sufficient to attract and retain salesmen of high caliber is more conducive to the development of business on the basis on which utilities want it than a commission schedule. The former usually costs less in the long run, and many competent salesmen dislike to work on a quota basis alone. But the salary must be large enough to attract and retain such men.

Indirect Lighting in Factories

BEFORE the advent of modern powerful and efficient light sources there was no science of illumination. With the relatively feeble sources then available the chief aim was to get the light center close to the work. This idea naturally persisted into the present age of adequate light sources, so that for a long time little importance was attached to the indirect component which could be reflected from walls and ceiling. Now informed persons know that their homes and offices cannot be cheerful unless an appreciable amount of light is reflected from the surrounding areas. The student of lighting knows that this same principle holds true in factories, but as yet it has not been generally adopted there. Of course, in factories there is the problem of maintaining reasonably high reflection factors for the ceiling; but the value of paint in making factories more cheerful and in increasing the efficiency of lighting—and also of workmen—is becoming widely recognized. However, factory lighting is still chiefly done by means of opaque reflectors directing the light generally downward. Glassware is now used to some extent, and recently a lighting unit consisting of a combination of diffusing glass and metal shade has been installed in some factories. These indicate that the principle of the indirect component is struggling for recognition in industrial lighting.

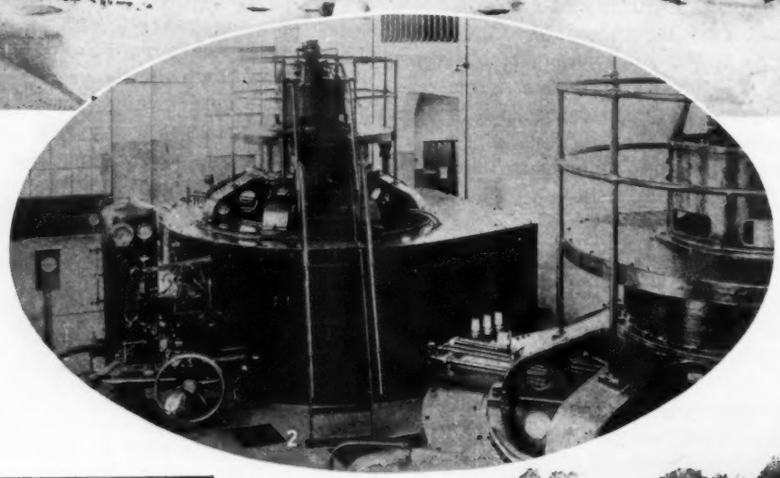
There is now on the horizon an important factor which will eventually introduce well-maintained ceilings and a powerful indirect component into industrial lighting. Only a few years ago 5 foot-candles was considered high-intensity lighting. Then came the 10-foot-candle ideal. Now 20 foot-candles is not unheard of in factories. With the growing recognition that production is increased by adequate and proper lighting, intensities of illumination are going to increase as rapidly as economic results permit until human eyes receive the same treatment indoors that they have been used to outdoors for ages. As the intensity of illumination is increased to 40 or more foot-candles, proper lighting without undue glare is going to demand that the ceiling play an important part. In other words, a powerful indirect component must be depended upon when this time comes. It appears certain that many who once viewed indirect lighting as more or less extravagant in fine residential interiors are going to see it play a real part in factory lighting. The "sky" must accompany the "sun" if there is to be comfortable lighting at high intensities.

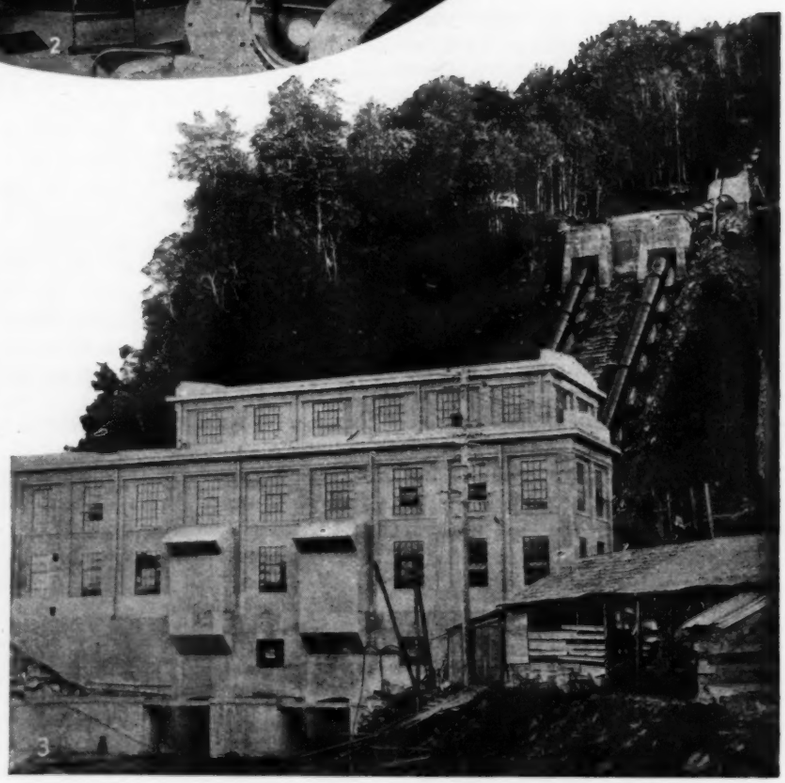
Where Engineering Statesmanship Is Needed

TRANSITION periods in public utility development call for far-sighted engineering and open-minded policies if costly mistakes are to be avoided and systems built up and co-ordinated on sound premises. The presence of expanding utility interests in large urban neighborhoods makes it difficult at times to solve problems of generating-plant and transmission-line construction on the basis of the greatest economic good to the community as a whole, on account of the business rivalry of the groups involved. Recent experience has shown that very keen competition for business may result in comparatively small areas occupied by electric light and power companies seeking to enlarge their loads, particularly where small municipal plants are being superseded by central-station supply on the wholesale basis.

Here is a clarion call for all such interests to exhaust all possible means of getting together and agreeing upon comprehensive programs of development in order that capital may not be wasted and needless losses incurred in territorial supply of energy. Within a few years there have been several very bad cases of duplication in generating-plant construction within confined territories in close proximity. These developments have been within the strict legal rights of the owning companies, but, as we see it, they have been economic mistakes of the first magnitude.

It may be that some companies have asked too high a price for their bulk service, that others have failed to create a reliability record sufficient to justify energy purchase, or it may be that company pride has dictated independent construction without much regard to comparative costs. We suspect that in some of these cases plant development has been authorized without a single hour of consultation among the grouped interests of the territory as to the best over-all scheme to meet the anticipated electrical needs of the given region for the next ten or twenty years. Reasons enough can be cited for failing to get together in this way, but we question whether these reasons are generally good enough to justify the failure. Independent plant construction within comparatively small areas should not be undertaken until a truly statesmanlike investigation of the possibilities of economic agreement on the best known program of plant, line and interconnection construction for the territory as a whole has been carried out. Otherwise the over-all cost of service to the public is bound to be higher than is necessary, and in these days no part of the industry can afford to expose itself to any such indictment.





Hydro-Electric Stations in the Japanese Alps

THE past few years have witnessed a large development of the water power of Japan. Many sites capable of economical development are located within practicable transmission distance of the large load centers. The Shinyetsu Electric Power Company of Tokyo has built the Nakatsugawa No. 1 and the No. 2 stations, shown in the accompanying illustrations, about 150 miles northwest of Tokyo in the Japanese Alps. The power they supply serves part of the industrial and lighting load of Tokyo and its suburbs. The generators in the stations are all manufactured by the General Electric Company.

Fig. 1—A winter scene—Nakatsugawa No. 1 plant, which operates under a head of 1,366 ft. and contains three 14,444-kva., 300-r.p.m., three-phase, 50-cycle horizontal generators.

Fig. 2—An interior view of No. 2 station.

Fig. 3—No. 2 plant uses a 552-ft. head and has two 10,000-kva. turbo-generators.

Analyzing Steam Heating Requirements

Methods Used by Union Electric Light & Power Company, St. Louis, to Determine Actual Steam Requirements and Amount of Exhaust Steam Wasted

By WARREN L. BERRY
Assistant Sales Manager Union Electric Light & Power Company, St. Louis, Mo.

IN DETERMINING the most economical method of supplying the heating and electrical requirements of the modern hotel, office building and similar structures, the engineer must face the problem of deciding between the generation of steam with purchased electricity and the operation of a power plant to supply both services. In order to arrive at an intelligent decision, it is necessary to determine the portion of the power plant operating expenses which are properly chargeable to heating and the part chargeable to electric generation.

In the case of the power plant, some portion of the heating will be supplied by steam exhausted from the engine. On this account much misinformation as to the cost of this heating has gained credence. Such expressions as "The engine acts as a reducing valve," or "Electricity is a byproduct of the heating load" have given many the impression that there is little, if any, extra expense for generating electricity in cases where boilers must be operated to supply steam for heating. Even some otherwise well-informed engineers are under this impression. One occasionally reads an engineering report containing some such statement as "The engine consumes only 10 per cent of the heat energy of the steam passing through it, the remainder going to the exhaust to supply the heating requirements of the building." Although this statement may be true, it leaves the false impression that 90 per cent of the heat of the steam is usefully employed by the heating system of the building.

Another instance of the failure of some engineers to take into account all of the facts to be considered is brought out by a recent article on the subject of exhaust steam in one of the trade journals. The author proceeds to determine the amount of heating steam required during each month of the heating season by the average temperature deficiency of the month below 70 deg. Having found the total amount of steam required to supply this deficiency, he divided this total by the number of hours in the month (excluding night time) and determined the average amount of steam required per hour. His calculations then provided for the utilization of exhaust at this average rate.

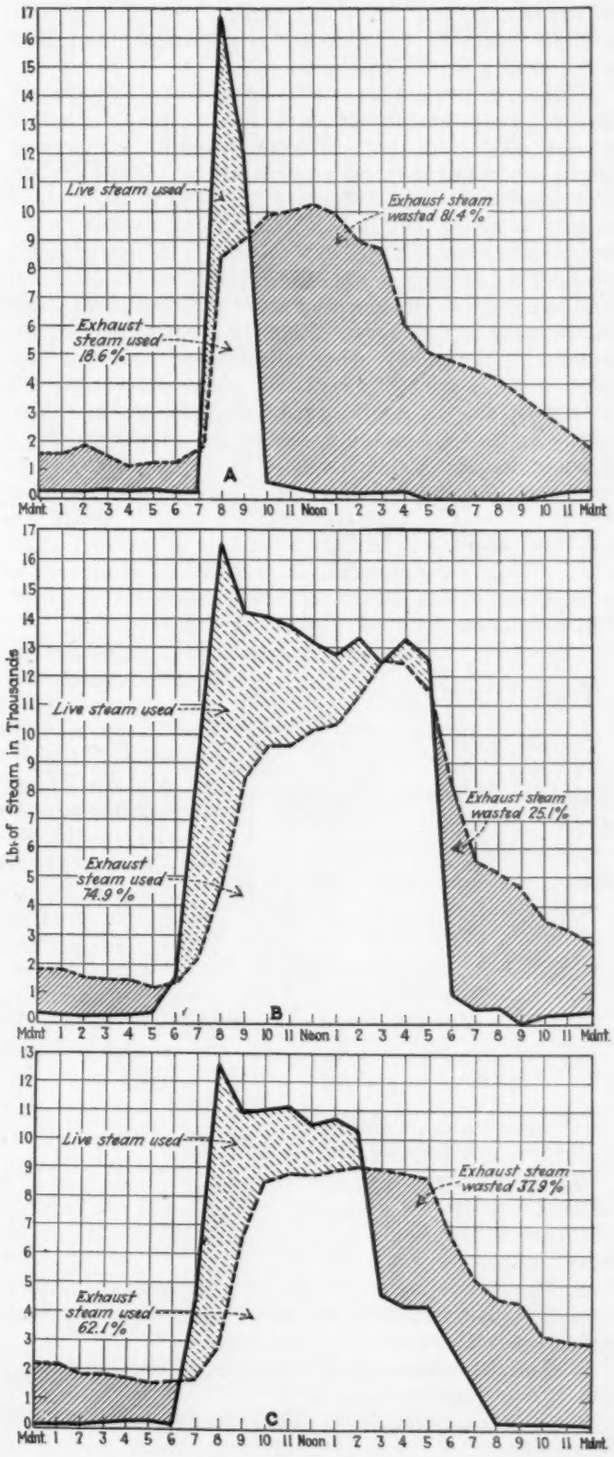

Lbs of Steam in Thousands
Live steam used
Exhaust steam wasted 81.4%
Exhaust steam used 18.6%
A
Live steam used
Exhaust steam wasted 25.1%
Exhaust steam used 74.9%
B
Live steam used
Exhaust steam wasted 37.9%
Exhaust steam used 62.1%
C
Midnt 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11 Midnt

FIG. 1 (A, B, C)—CHARTS SHOWING STEAM-HEATING REQUIREMENTS AND WASTE OF EXHAUST STEAM FOR AVERAGE DAYS IN OCTOBER, DECEMBER AND MARCH

Engineers must not overlook the fact that there is no commercially efficient means of storing either the heat of the exhaust steam or the heat electricity generated; each must be disposed of as generated and there is no synchronism in the heating and electrical demands of buildings such as we have under consideration. At times the heating demand exceeds the electrical demand and it is necessary to send live steam direct from the boiler to the heating system to make up the deficiency

in exhaust steam. At other times the exhaust steam available exceeds the heating requirements and it is then wasted to the atmosphere.

These conditions are necessarily true, because the heating requirements of each month of the heating season differ, so that different amounts of heating steam are required in each month of the heating season. Not only does this difference in demand exist from month to month but it exists from day to day as the temperature varies from day to day. Furthermore, the demand for heating steam differs from hour to hour, for cold buildings in the morning often consume more steam in the warming up process than is required during the remainder of the day, when only the radiation and ventilation losses are being replaced. (See October curve.)

It must also be remembered that more steam will be available in the lighting hours of the evening, when a greater amount of electricity is being generated, than in the earlier and brighter hours of the day. In other words, when the requirements for heating steam are greatest, there is a minimum amount of exhaust available. When the requirements for heating steam are at a minimum, electrical generation is greatest and a maximum amount of exhaust steam is available.

Therefore it must be evident that it cannot be assumed that the cost of generating electricity consists entirely of the 10 per cent to 20 per cent heat loss in the cylinder of the engine. It is apparent that all the factors mentioned must be taken into account in determining the proper division of cost between the two usages to which the steam is put. In this study of the subject, attempt is made to give proper value to these factors in arriving at a basis for division of costs.

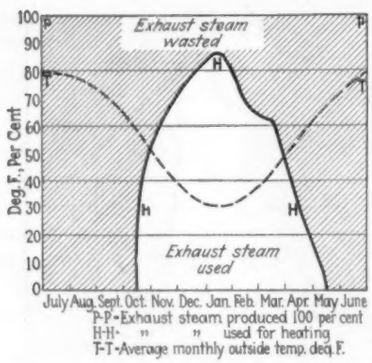


FIG. 2—DISPOSITION OF EXHAUST STEAM DURING A YEAR

The starting point in our study was the selection of a suitable building and the determination of the requirements of this building with respect to the two classes of service, viz:

1. The determination of the varying amounts of electricity required throughout the 24 hours of a representative day for each month of the year.
2. The determination of the requirements for heating steam coincident to the above.

Having this information, the following can be readily deduced:

1. The amount of exhaust steam usefully employed for heating.
2. The amount of exhaust steam wasted.
3. The amount of live steam required for heating.
4. Percentage of operating costs chargeable to heating.
5. Percentage of operating costs chargeable to electric generation.

The Weather Bureau of the United States Department of Agriculture has issued data showing the average temperatures for this locality during the last 51 years. From these data can be selected a day of normal temperature for each month of the year, and the day so selected will represent average temperature conditions of the month.

TABLE I—DISTRIBUTION OF LOW-PRESSURE STEAM FOR EACH MONTH, USING THE DAILY NORMAL AVERAGE TEMPERATURE FOR EACH PARTICULAR MONTH

Month	Live Steam Used	Exhaust Steam Used	Exhaust Steam Wasted	Total Available Exhaust	Total Heat Steam
October	356,500	694,400	3,034,900	3,729,300	1,050,900
November	791,400	2,346,600	1,356,900	3,703,500	3,138,000
December	1,364,310	3,353,425	1,121,735	4,475,160	4,717,735
January	2,463,880	3,289,720	523,280	3,813,000	5,753,600
February	1,718,920	2,198,280	1,048,320	3,246,600	3,917,200
March	824,662	2,355,566	1,436,044	3,791,610	3,180,228
April	355,200	703,500	2,944,500	3,648,000	1,058,700
May	.....	.....	3,782,000	3,782,000	.....
June	.....	.....	4,218,000	4,218,000	.....
July	.....	.....	4,161,750	4,161,750	.....
August	.....	.....	3,933,900	3,933,900	.....
September	.....	.....	3,825,000	3,825,000	.....
Total	7,874,872	14,941,491	31,386,329	46,327,820	22,816,363

Records of the steam and electrical requirements of buildings in which both of these commodities are purchased and quantities used are measured by meters give us exact information as to the hourly requirements of these buildings, so that we are in possession of a graphic record of the steam and electrical requirements of such buildings during a day of mean temperature for each month in the year.

We can readily transpose the electric load curve into a steam curve by assuming a reasonably attainable water rate for a non-condensing engine of size and type most commonly used in buildings of this character. Having done this, we are in possession of the high-pressure steam requirements for generation. This curve will also represent the exhaust steam available for heating, as in passing through the engine cylinder the steam will have dropped in pressure and temperature by the conversion of heat energy into mechanical energy.

Our curves now represent the steam required for heating and the exhaust steam available for heating for an average day for each month in the year. Even a superficial examination of these curves reveals that a portion of the steam required for heating must come direct from the boiler without passing through the engine. It is seen that part of the exhaust steam is usefully employed in heating and part is wasted. The division of steam for the year, as revealed by the graphic record, is given in Table I.

It is apparent from the table that only 32 per cent of exhaust steam is usefully employed in the heating system and the remaining 68 per cent is wasted to the atmosphere; also that of the steam actually used for heating purposes only 65 per cent is supplied by exhaust steam, the remaining 35 per cent being supplied as live steam direct from the boiler.

From these data we are able to apportion costs of the two classes of service supplied by the plant—that is, steam heating and electricity. Assuming an evaporation of 5 lb. of water per pound of coal burned, we arrive at the allocation of coal consumed in the plant shown in Table II.

TABLE II—DIVISION OF TOTAL COAL CONSUMED

	Tons	Per Cent
Coal used for live steam heating	787.5	12.6
Coal used for exhaust steam heating	1,494.1	24.0
Coal used for exhaust steam wasted	3,138.6	50.3
Coal used for generation (deduced)	817.5	13.1
Total	6,237.7	100.0

These data can be further reduced to the following division of cost with respect to fuel:

	Tons	Per Cent
Cost of heating (live and exhaust steam)	2,281.6	36.6
Coal of generation (engine and wasted exhaust)	3,956.1	63.4

This study seems to prove the fallacy of the total usage of exhaust steam. It may prove surprising to some to learn that only 32 per cent of the exhaust steam is usefully employed in the heating system and in addition to this exhaust the heating system demands live steam to an extent of 35 per cent of the total heating requirements. It must also be evident that electricity is by no means a byproduct of the heating plant, for 63.4 per cent of the coal expense is attributable to generation alone.

These results seem to be in harmony with a similar investigation in Denver reported in the ELECTRICAL WORLD and a study of New York conditions made by R. P. Bolton and an article covering a Chicago investigation reported in the *Bulletin* of the National District Heating Association, which stated, "The waste of exhaust steam was more than three times as great as the quantity of steam usefully employed in the production of energy."

Test Data on Oil Burner

Philadelphia Electric Company Obtains Costs and Efficiencies—Burner Makes Desirable Load for Central Stations

THE laboratories and testing division of the Philadelphia Electric Company has recently completed a series of tests, made under the direction of H. M. Keebler, to determine the efficiency and economy of an oil burner for use with a house furnace and its desirability as a central-station load. The machine tested was the Marr oil heat machine, which is now being sold by the commercial department of the company. Records were kept on an actual service installation at 1826 68th Avenue for a period of 50 days from Feb. 2, 1926, to March 12, 1926. The burner was installed in an American Radiator Company's Arco 3-23, W-Series No. 23-1 B hot-water boiler, to which was connected 580 sq.ft. of radiation. The house consisted of eight rooms, including an inclosed porch and a heated garage in the basement, and was of brick with two frame bay windows and heat insulation that could be classed as ordinary for this type of house.

The principal parts of the oil burner were as follows:

A ¼-hp. General Electric 110-220-volt, 60-cycle, alternating-current 1,725-r.p.m. motor.

TABLE II—BOILER EFFICIENCY FROM COMBUSTION DATA

		Per Cent
Stack loss	91,900 B.t.u.	11.64
Loss due hydrogen in oil	70,200 B.t.u.	8.89
Radiation loss	74,000 B.t.u.	9.37
Total loss	236,100 B.t.u.	29.90
Boiler efficiency		70.10

TABLE III—COST DATA

Cost over test period—50 days, from	2/3/26 to 3/25/26
Average outside temperature	31 deg. F.
Average inside temperature	75 deg. F.
Oil:	
678.25 gal. burned at eight cents per gal.	$54.25
Electricity:	
132.5 kw.-hr. at three cents per kw.-hr.	3.98
Gas:	
5,576 cu.ft. at $1 per 1,000 cu.ft.	5.58
Total cost—50 days	$63.81
Average cost per day	1.28
Estimated cost of equivalent heating with coal at $16 a ton (2,240 lb.) and containing 13,500 B.t.u. per pound, with a boiler efficiency of 52 per cent:	
Tons of coal required 4.1 at $16 per ton	$65.60
Cost per day	1.31

An oil pump to supply fuel to the burner.

A metering device to measure oil supplied for burning.

A pressure-regulating valve to maintain fuel from the pump under pressure through the metering device.

Fan and atomizing cone and collar driven from the same shaft within the furnace to supply through centrifugal action a fine spray of oil and sufficient air for proper burning.

A firebrick basin beneath the fan and atomizing cone.

A ring gas jet burner in basin, and gas pilot.

Safety device.

Program switch controlling the operation of the machine and actuated by the room thermostat.

The moving parts of the machine were operated through a shaft coupled to each end of the motor. The fuel pump and metering device were driven from one end of the motor, and the centrifugal atomizer and fan from the other. The operation of the machine was controlled by a thermostat located in the living room. When the room temperature fell below that set on the thermostat, the action of the thermostat operated the "program switch" on the machine. The operation of this switch caused the motor to start and gas to flow through the ring jet burner, where it was ignited by the pilot flame. The atomized oil whirled out over the collar and in presence of the air supplied by the fan was ignited, and positive burning of the atomized fuel was obtained by maintaining the ring gas flame for about two minutes. At the end of this time the firebrick basin was heated enough to carry on regular operation.

The fuel supply for continuous burning was obtained by the fuel pump drawing oil from the storage tank through a strainer and forcing it under the adjusted pressure through the metering device—a stationary and movable disk with a ⅛-in. hole in each disk, allowing oil

TABLE I—QUANTITIES OF OIL, ELECTRICITY AND GAS USED DURING 50-DAY OIL-BURNER TEST

From 10 A.M.	To 10 A.M.	Operation, Hours: Per Period	Per Day	Oil: Total Gal. Per Period	Electricity, Kw.-Hr.: Total Kw.-Hr. Per Period	Per Day	Per Oper. Hr.	Gas: Kw.-Hr. per Gal. Oil	Total Cu.Ft. per Period	Temperature, Deg. F: Average Outside	Average Inside
2/3/26	2/5	30.25	15.1	38	8.0	4.0	0.265	0.211	230	28	74.3
5	9	41.03	10.25	52.75	14.0	3.5	0.342	0.266	452	30	75.2
9	10	13.56	13.56	11.75	3.0	3.0	0.222	0.256	114	25	74.3
10	12	30.05	15.02	39.25	10.0	5.0	0.333	0.255	224	23	75.2
12	16	40.18	10.05	50.0	12.0	3.0	0.299	0.240	444	33	77.0
16	20	40.45	10.1	49.0	8.8	2.2	0.218	0.180	452	34	77.0
20	26	56.55	9.4	67.0	13.4	2.25	0.237	0.200	666	36	77.0
26	3/3	56.55	11.3	85.75	14.0	2.80	0.322	0.164	550	29	76.1
3	12	106.3	11.8	123.25	25.0	2.78	0.235	0.200	1,002	33	75.2
12	25	97.25	7.44	161.5	24.3	1.87	0.250	0.153	1,442	38	77.0
Total 50 days		512.12	10.25	678.25	132.5	2.65	0.259	0.1955	5,576	30.9	75.83

to pass only when the holes coincided—to the atomizing cone. The excess oil pumped was returned to the storage tank through the return line.

When the proper temperature in the living room was attained, the thermostat opened the "program switch" and stopped the operation of the machine. At the same time a governor type valve in the metering device closed the pump discharge line ahead of the two measuring disks, preventing any further flowing of oil.

METHOD OF TEST

The oil consumption was obtained by depth gage measurements in the oil storage tank. This method of measurement gave accuracy within 0.3 of a gallon.

The current consumption was obtained by an integrating kilowatt-hour meter installed in the motor circuit. The number and length of operating periods was obtained from charts of a graphic ammeter installed in the motor circuit.

The temperatures of the supply and return water to the heating system, inside and outside air temperatures were obtained by thermocouples attached to a recording potentiometer. The thermocouples used for obtaining the water system temperatures were secured to the outside of the pipes at the boiler with cement and covered with asbestos and tape. The temperature gradiant of the pipe was obtained by difference of thermocouple and the standard thermometer readings under the same conditions with the thermometer in a well in direct contact with the water.

The stack temperature was obtained by a recording thermometer, the bulb of which was placed in the stack at the connection to the boiler. The flue gas obtained from the point of leaving the boiler was analyzed by an Orstat apparatus. The air supplied for combustion was measured by an anemometer and wind tunnel constructed around the burner.

Record of the different temperatures, oil and energy consumption was taken at intervals of four or five days throughout the test, which began at 10 a.m., Feb. 3, 1926, and concluded March 25, 1926, at 10 a.m. The date from which boiler efficiency was calculated was obtained during the period March 24 and 25.

CONCLUSIONS FROM TEST

The accompanying condensed tables give the actual results of the test and the following conclusions were arrived at by the testing division:

1. That the economy obtained during this test could be improved if the boiler were insulated. This alone would probably increase the boiler efficiency 5 to 6 per cent. A still further increase in efficiency could be obtained if a boiler with efficient heating surface were available. This gain would be obtained by reducing the stack loss to a minimum.

2. That perhaps hydrostatic control of the heat machine would be preferable to the thermostatic control employed during the test.

3. That the total electrical load per season per oil burner compares very favorably with the refrigerator load, and is deserving of being developed by the public utilities.

4. That the personal element in the home having an oil burner is responsible for greater cost than operation with coal, when such is the case.

The conclusion that the total electrical load per season compares favorably with a refrigerator load is particularly interesting from a central-station point of view. The average figure of 0.2 kw.-hr. per gallon of oil burned over the average of ten operating hours per day gives an energy consumption of 2 kw.-hr. per day as a season's average for a house with 600 sq.ft. of radiation and ordinary construction. The rate of three cents per kilowatt-hour used in the report is based on the fact that homes operating oil burners in Philadelphia would use enough kilowatt-hours in three months for light and other uses to be entitled to this rate under the existing schedules.

TABLE IV—ESTIMATED COSTS FOR 210-DAY HEATING SEASON
Average temperatures, 40 deg. F. outside, 75 deg. F. inside

Oil:			
2,100 gal. oil at eight cents per gal.			$168.00
Electricity:			
4,200 kw.-hr. at three cents per kw.-hr.			12.60
Gas:			
Cubic feet on basis of average—111 cu.ft. per day—23,300 at $1 per 1,000 cu.ft.			23.30
Total cost			$203.90
Cost per day			0.97
Equivalent coal-heating cost, boiler efficiency 52 per cent, 13,500 B.t.u. per pound of coal, $16 a ton of 2,240 lb.:			
Tons of coal required, 12.85, at $16 per ton			$205.50
Cost per day			0.98
Estimated season's heating covering same period with average outside temperature of 40 deg. F. and average inside temperature 70 deg. F.			
Oil	Total cost	$185.00	$0.881 per day
Coal	Total cost	186.00	0.886 per day

Two More Swiss Hydro Stations Planned

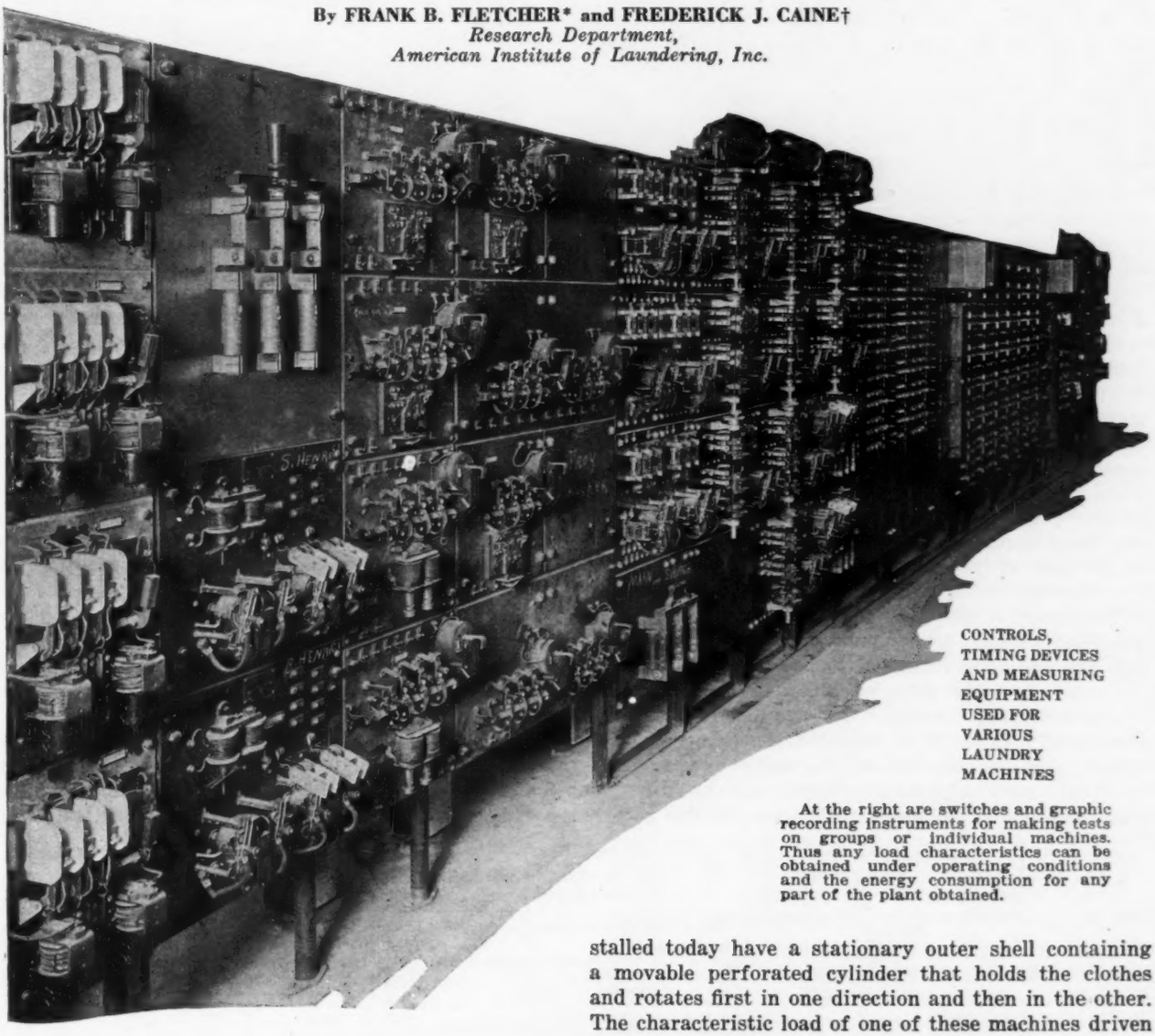
NEGOTIATIONS are said to be proceeding between the St. Gall-Appenzell Electric Power Company and the authorities of the Canton of Glarus for the construction of an unusual hydro-electric station to utilize the water power of Lake Mutten, the Limmern Falls and the Upper Linth River in east Switzerland. The scheme has been under consideration for some years, the original idea being to establish in two stages a winter-period generating plant, the first stage providing for an output of 22,500,000 kw.-hr., with a later extension to 39,000,000 kw.-hr. A new design has now been adopted which provides for a 115,000-hp. station capable of being run the whole year round, and of producing 116,000,000 kw.-hr. annually, 55,000,000 in the winter months and 61,000,000 in the summer. This result will be obtained by utilizing Lake Muttern to supply the water in winter, with the Limmern Falls intake as a supplementary feeder, while the River Linth will furnish the power in summer. The conduit pipes will all be concentrated on the single generating station, which will be built at Tierfeld, near Linthal. The cost of the installation is estimated at $10,292,000.

Some further particulars of the new Ryburg-Schworstadt station, which is to be established on the Rhine as a joint enterprise of the Baden (Germany) Provincial Electric Supply Company and the North East Swiss Electric Power Company, were given at the recent annual meeting of the Rheinfelden Electric Power Transmission Company. The new plant is to have an eventual capacity of not less than 110,000 hp., the cost of construction being estimated at $12,000,000, half of which will be raised by capital stock and half by debenture bonds. The Baden authorities and the Swiss government are each subscribing for a quarter of the capital stock, the remaining half being taken up in equal proportions by the Motor Colombus Company of Baden and the Rheinfelden Company.

Electric Power in the Laundry Industry

Electric Operation and Control Particularly Advantageous for Labor-Saving and Safety Reasons—Load Fluctuates Considerably with Individual Drives Unless Operations Are Staggered

By FRANK B. FLETCHER* and FREDERICK J. CAINE†
Research Department,
American Institute of Laundering, Inc.



CONTROLS, TIMING DEVICES AND MEASURING EQUIPMENT USED FOR VARIOUS LAUNDRY MACHINES

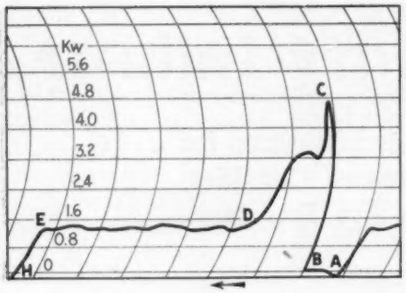
At the right are switches and graphic recording instruments for making tests on groups or individual machines. Thus any load characteristics can be obtained under operating conditions and the energy consumption for any part of the plant obtained.

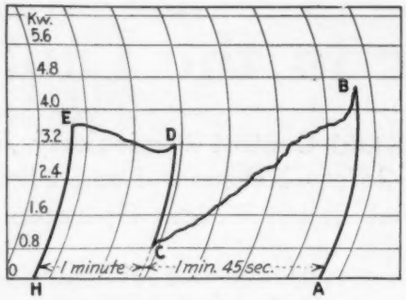
IN THE modern laundry, all equipment so far as possible is electrically operated and controlled, the chief advantages being the general safety and saving of labor afforded. Group drives with a maze of belts have largely given way to individual drives, but the total load with the latter is likely to have considerable fluctuations unless some such precautions as staggering operations are taken. To illustrate this fact as well as to indicate the characteristics of the individual loads, some of the major operations in a modern commercial laundry connected with the research department of the American Institute of Laundering will be presented.

Washing.—The majority of washing machines installed today have a stationary outer shell containing a movable perforated cylinder that holds the clothes and rotates first in one direction and then in the other. The characteristic load of one of these machines driven by an individual motor is shown in Fig. 1.

The cylinder of this machine rotates three and one-half times in one direction and then reverses the same number of times. About ten seconds elapses between the beginning of rotation in one direction and that in the opposite direction. The peak load of each cycle is obtained at the beginning thereof in reversing the direction of rotation and bringing the loaded cylinder up to speed. For this particular machine the peak load is 4.7 kw. About 30 per cent of the beginning of cycle is required to bring the cylinder up to speed; during this time the load drops off to about 1.35 kw.—the normal running load—which is maintained for about 60 per cent of the cycle. Then the machine coasts about one second and the motor reverses the direction of rotation, going through the same cycle as outlined.

*Chairman of Research Committee. †Research Engineer.





FIGS. 1 AND 2—CHARACTERISTIC LOAD CYCLES OF A 42X84-IN. WASH WHEEL AND A 48-IN. EXTRACTOR

E H—Motor stops for reversal.
B C—Starting peak load.
C D—Attaining full speed.
D E—Average running load.
E H—Motor stops for reversal.

A B—Starting peak load.
B C—Attaining full speed.
C D—Application of electric brakes.
D E—Braking load.
E H—Machine stopped, brake released.

Extraction of Water.—Most extractors also consist of a stationary outer shell inclosing a movable perforated basket for holding the goods and rotating at 700 to 1,200 r.p.m., depending on the type. The characteristic load of one such machine is shown in Fig. 2.

For this particular machine and under the conditions existing the cycle of operation consumed two minutes and 45 seconds. The starting peak, which was momentary, was about 4.6 kw. About 64 per cent of the cycle was required in bringing the machine up to speed, during which time the load dropped to 0.9 kw. Then the electrodynamic brake is applied, causing a smaller peak of 3.2 kw., this load decreasing slightly and then increasing to 3.6 kw. for a little more than 36 per cent of the cycle, after which the cycle repeats.

A laundry having several machines of this type must of necessity be very careful not to have more than one machine starting or stopping at the same time. So far no staggering devices have been perfected for use in conjunction with these machines.

Rough Drying.—Articles that are to be rough dried are placed in a tumbling machine, consisting of a stationary outer casing and an internally rotating steel-mesh cylinder which rotates a few times in one direction and then the same number of times in the reverse direction, the number of revolutions depending on the nature of the clothes and the time required to dry them. The characteristic load of this machine is similar to that of the washing machine in Fig. 1.

Ironing.—Flat goods are usually ironed by passing them over highly finished steam-heated chests or cylinders. The machine, if of the individual-drive type, is operated by an adjustable-speed motor. Body garments are pressed on padded, steam-heated plates, the top cover of which is made to descend under pressure mechanically. The machines are operated either by a continuous running motor equipped with a clutch or by an intermittent motor of less than 1 hp.

Miscellaneous.—A number of other machines are necessary to carry out the different finishing operations, and they are operated by constant-speed motors, but their load does not have any material effect on the total of the plant so far as fluctuations are concerned.

TOTAL LOAD AND EFFECT OF STAGGERING OPERATIONS

As indicated by the total plant load (Fig. 5) of the commercial laundry used in conjunction with the research department of the American Institute of Laundering, the fluctuations are very appreciable. This is due to the fact that only half of the total number of reversing machines are staggered in operation, the other machines working independently of one another. If all of the machines were staggered in operation, a more uniform load would result and thereby increase the load factor of the plant. Just a section of the load curve illustrated shows fluctuations ranging from 8 kw. to 36 kw., with an average load of possibly 18 kw.

The possibility of decreasing the fluctuations in the total load of reversing machines is illustrated by Figs. 6 and 7. In the first illustration six washing machines having a total connected load of 14 hp. were staggered

BASIS ON WHICH LAUNDRIES FIGURE POWER COSTS

Item	Per Cent Initial Cost of Total Investment*	Depreciation, Years
Boiler equipment and installation	12	20
Stoker equipment and installation	5	15
Stack equipment and installation	9	30
Boiler instruments installation	4	10
Heater equipment installation	14	20
Softener equipment installation	31	20
Engine, generator installation	11	12
Switchboard installation	9	15
Engine instruments	3	10
Central-station installation	2	15
Total	100	

Value of productive floor space per year, 40.27 cents per square foot*.

Interest rate = $\frac{\text{Life of equipment in years} + 1}{\text{Life of equipment in years}} \times \frac{\text{Investment} \times 0.06}{2}$

*Ten per cent of steam passed through engine charged to power generation; remaining 90 per cent charged to process work.

BASIS FOR FIGURING GENERATED POWER COST

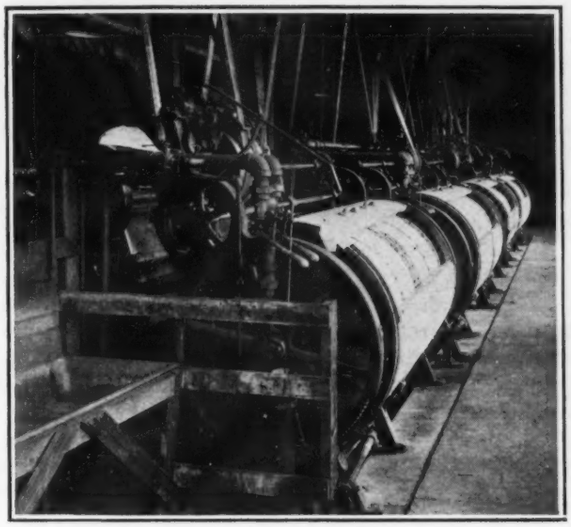
(Plus utility emergency or auxiliary service)

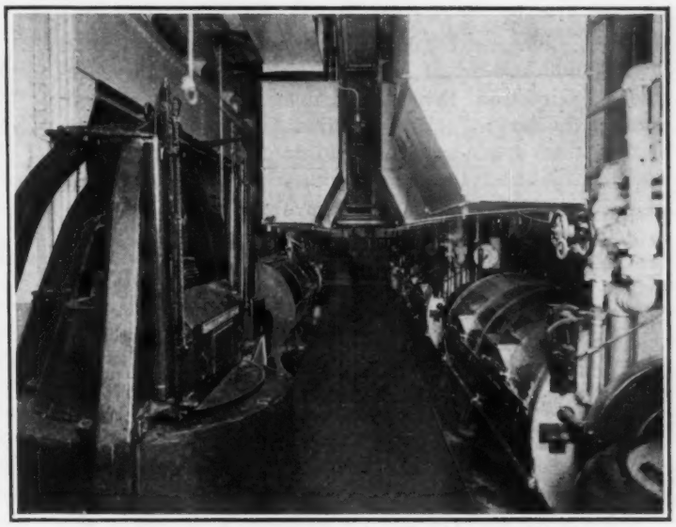
Fixed Charges	Per Cent of Total*
Depreciation, interest, taxes, insurance:	
Engine and equipment	11.4
Engine instruments	3.3
Switchboard	7.6
Central-station connection	1.8
Floor space for engine and switchboard (see kw.)	2.6
Total	26.7
Operating Cost	
Maintenance	6.3
Repairs and supplies	1.0
Oil	1.8
Engineer	6.6
Supervision	3.0
Steam used by engine (10 per cent of that passed)	8.8
Purchased emergency or auxiliary service	28.6
Purchased light	17.2
Total operating cost	73.3
Total fixed charges	26.7
Grand total	100.0

BASIS FOR FIGURING PURCHASED POWER COST

Fixed Charges	Per Cent of Total*
Depreciation, interest, insurance and taxes:	
Central-station connections	1.35
Switchboard	5.79
Floor space for switchboard (see basis of charge)	.70
Total	7.84
Operating Cost	
Demand charge	33.56
Energy charge	61.45
Total without discount	95.01
Discount	2.85
Total operating cost	92.16
Total fixed charges	7.84
Grand total	100.00

* Based on the Institute's installation.





FIGS. 3 AND 4—OLD AND NEWER DRIVES FOR LAUNDRIES

At left, Fig. 3—A group of washing machines installed several years ago driven by overhead belts.
At right, Fig. 4—Modern washing machines in the commercial laundry of the American Institute of Laundering, Inc., driven by individual motors on top of machines. Individually driven extractors are shown at left. Note overhead conveyor loading system.

in operation with respect to one another. During the period indicated the fluctuations ranged from about 2 kw. to a little more than 8 kw., the average load being in the neighborhood of 5 kw. The same six machines but with two other machines of different types having a connected load of 8 hp. and running independently of each other as well as the six staggered machines produced, during the periods indicated, fluctuations ranging from 4 kw. to 28 kw., with an average load of possibly 12 kw. If all the machines represented in Fig. 7 had been staggered in operation, there would have been no increase in the peak load and less than 2 kw. increase in the average load.

No power factor recorder was available at the time of these tests, but the indicated power factor during the load indicated by Fig. 1 fluctuated between 55 and 77 per cent.

LAUNDRIES' METHOD OF FIGURING COSTS

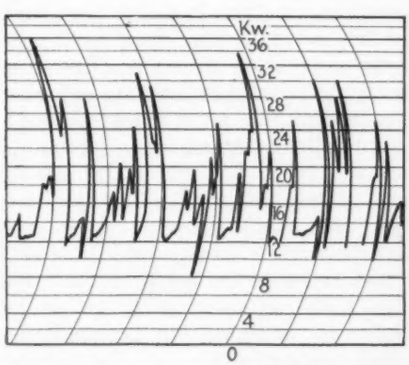
In October, 1925, the American Institute of Laundering, Inc., published a report, "Covering the cost of producing steam and electric power and a comparison of the cost of generating and purchasing electric power," in the commercial laundry plant of the Institute. Copies of this report can be obtained from the Institute. In this report interest is figured on a straight line or fixed annual amount basis, using the formula:

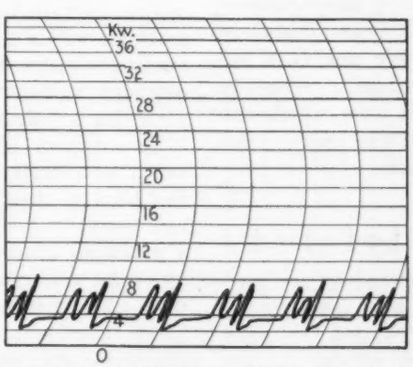
$$\frac{\textit{Life of Equipment in Years} + 1}{\textit{Life of Equipment in Years}} \times \frac{\textit{Investment} \times 0.06}{2}$$

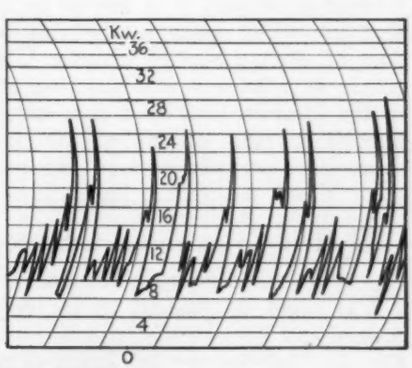
For a fifteen-year depreciation period this formula gives an interest charge of 3.2 per cent per year. The value of floor space is taken on a productive basis. For figuring depreciation the straight-line method, or a fixed annual amount of the original cost of the equipment, was used. Only 10 per cent of the cost of the steam passed through the engine was charged against it, the remaining 90 per cent being charged to heater-operating expense. Power-plant supervision was charged at $10 a week in addition to the regular operating labor.

Emergency service from a utility company might be considered as an insurance expense, and in some cases it is, but the Institute feels it should be given the same treatment as in charging off an auxiliary generating unit and for that reason is treated accordingly.

The cost of purchased power is based on a maximum demand charge of $2.50 per kilowatt, and a step-energy







FIGS. 5, 6 AND 7—EFFECT OF STAGGERED OPERATION OF LAUNDRY MACHINES

Fig. 5—Fluctuating character of individual-drive laundry load unless staggered. Only half of the reversing machines are staggered in operation to give diversity and prevent excessive peaks. The remaining machines work independently of one another. If all the reversing machines were staggered, a more uniform load would be obtained.

Fig. 6—Load fluctuations greatly reduced by staggering. Six washing machines are in operation with a load of 14 hp.

Fig. 7—Effect of operating one-quarter of machines unstaggered. The same six washing machines represented by Fig. 6 are operating in conjunction with two other machines (having a connected load of 8 hp.) but not staggered in operation. If all the machines were staggered the peak load would be the same as in Fig. 6 and the average load only about 33 per cent higher.

rate of 5, 4, 2, 1.2 and 0.9 cents per kilowatt-hour for the first 1,000, next 2,000, next 2,000, next 25,000 and next 70,000 kw.-hr. of consumption per month respectively. Direction, interest, insurance and tax charge against the service equipment installed by the customer and the floor space occupied thereby take a fixed charge based on productive value of other parts of the plant.

Although some laundries figure that it is cheaper to generate their own power than to purchase it, this depends on local conditions, such as the cost of purchased power, the capacity and load factor existing. The laundry industry is one in which heat over and above that used for the generation of power is required to produce the finished product. Electricity, which is desirable as a substitute for steam power, has not yet

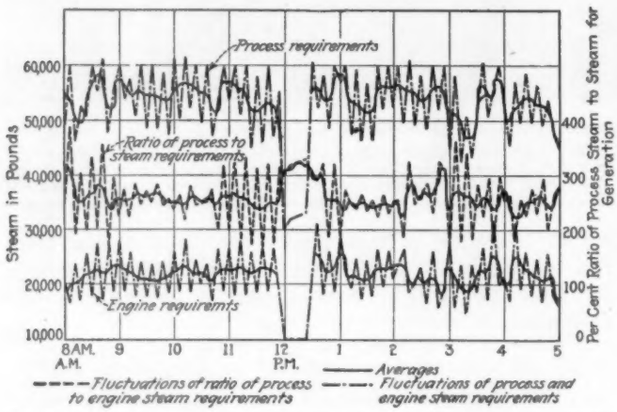


FIG. 8—RELATION OF LAUNDRY PROCESS STEAM REQUIREMENTS TO PRIME MOVER STEAM DISCHARGE

Readings were recorded every six minutes during one day. The fluctuations are due to the duty cycles of the reversing machines such as washers and tumblers. It may be observed that the process steam requirements average about 2½ times the available steam from the generator prime mover. The process steam requirements do not vary with the generator requirements.

come into general use in laundries for process heating. Large quantities of water must be raised to temperatures ranging from 170 to 190 deg. In addition, a laundry must of necessity operate its own boiler, maintaining high-pressure steam for heating laundry machinery which is universally designed for pressures of at least 100 lb. These facts have a considerable bearing on the generally accepted methods of laundry operation.

Despite existing practices of the laundry industry, which, it is believed, have been based on sound engineering principles, it is unwise to ignore developments that are being made in the vast and ever-expanding field of electric-service utilities. Every per cent increase in efficiency and fraction of a cent reduction in the kilowatt-hour cost reduces just that much the narrow margin on which the laundry owner can operate his own power plant economically.

Hydro Concession Granted by Iceland

A 60-YEAR concession has been granted by the government of Iceland to the chemical factories of Iceland and the Danish-Icelandic Construction Company for the development of hydro-electric power in the northern country, the Department of Commerce has been advised. Five large waterfalls in Arnarfjord, with a total capacity of 40,000 hp., must be utilized. The terms provide that the work must begin within four years and the power plants completed within three years.

114 Systems of More than 50,000 Kva. Rating

Small Company Operations Materially Reduced Through Mergers and Interconnections—Buying Power of Industry Concentrated in Larger Companies

A CLEAR picture of the national trend toward interconnection and the centralization of power production in the electric light and power industry is to be found in the accompanying tabulation of central-station systems grouped in accordance with total rating of installed generators and transformers in cases where companies purchase their energy, all the data being approximately as of July 1, 1925. There are at the present time 114 systems with a generator or transformer rating of more than 50,000 kva. Of these companies 91 generate all their own energy, 21 generate and also purchase energy and only 2 purchase all their energy. These companies have a combined rating of 19,352,002 kva., or 69.3 per cent of the total rating of all the systems in the country. In previous tabulations of this nature (ELECTRICAL WORLD, Oct. 20, 1923, and Aug. 8, 1925) it was indicated that on Oct. 1, 1922, there were 81 systems generating all their energy and on July 1, 1924, a total of 95 systems generating their energy. During the one-year period from July 1, 1924, to July 1, 1925, therefore, it appears that four of these larger companies, as the result of interconnection, have become purchasing as well as generating companies.

A more noticeable and significant trend, reflecting the results of further interconnection of systems, is pictured by the large decrease in the number of small companies generating all their own energy. On Oct. 1, 1922, a total of 3,073 companies with a generator rating of under 500 kva. were generating all their energy. By July 1, 1924, this number had decreased to 2,321 and on July 1, 1925, to 2,091, so that during the three-year period a total of 981 of these small companies took advantage of interconnection and entered the energy-purchasing class of companies. In many cases this transition involved the complete financial absorption of the company by the system supplying the energy.

As the high-tension transmission lines are further extended, making available the more reliable service of large generating plants, the existence of the small plants will become more and more limited. There are, of course, certain isolated communities in thinly populated sections which must depend upon the small local generating plant until the population grows and industry develops sufficiently to warrant the expense of constructing a long transmission line from a central point.

This growth in the number of companies functioning solely as distributors of energy has materially altered the buying structure of the industry. Twenty years ago more than 95 per cent of the country represented a potential market for electrical and power equipment from the generator and boiler to the house meter. Today 1,738 companies have no generating or power house equipment, have no high-tension transmission lines and are potential markets solely for distribution equipment. It is estimated that during 1926 approximately 95 per cent of the total expenditures for additions and extensions will be spent by 832 companies, or less than 16 per cent of the operating companies of the country.

Central-Station Systems Grouped in Accordance with Total Rating of Generators or Transformers

STATE	Systems Under 50 Kva.		Systems from 51 to 100 Kva.		Systems from 101 to 250 Kva.		Systems from 251 to 500 Kva.		Systems from 501 to 1,000 Kva.		Systems from 1,001 to 2,500 Kva.		Systems from 2,501 to 10,000 Kva.		System from 10,001 to 25,000 Kva.		Systems from 25,001 to 50,000 Kva.		Systems Over 50,000 Kva.	
	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.
United States	1,219	49,135	745	59,472	1,088	188,192	698	264,575	469	344,121	359	592,955	307	1,530,356	148	2,368,499	88	3,160,137	114	19,352,002
New England	51	2,031	32	2,586	50	8,298	42	16,003	40	29,978	41	68,594	53	262,216	21	332,259	17	581,353	9	857,443
Middle Atlantic	83	3,523	60	4,861	84	14,269	63	32,752	53	39,032	45	74,002	47	211,303	25	408,660	17	653,917	28	6,525,787
South Atlantic	116	4,574	103	8,472	160	26,102	98	37,601	70	53,024	44	65,822	43	232,251	19	303,752	6	204,056	15	2,481,430
East North Central	257	10,034	151	12,032	208	35,479	145	52,804	100	71,195	71	120,859	54	298,582	27	427,649	26	867,656	27	4,464,542
West North Central	466	18,700	186	14,241	289	48,987	123	42,887	82	59,095	59	94,921	39	214,705	19	323,493	6	207,317	10	1,024,665
East South Central	53	2,034	59	4,724	61	10,510	59	21,404	21	16,318	13	24,597	13	65,466	10	149,097	1	28,920	3	666,909
West South Central	96	4,538	81	6,396	131	24,043	96	35,362	43	30,118	31	51,924	29	115,296	11	193,520	4	198,548	4	370,584
Mountain	59	2,227	47	4,018	76	13,920	47	16,544	40	29,683	33	53,905	16	69,074	8	116,781	5	166,545	3	578,781
Pacific	38	1,474	26	2,142	29	4,584	25	9,218	20	15,678	22	38,331	13	61,463	8	113,288	6	251,825	15	2,381,861
New England																				
Maine	17	679	14	1,142	17	2,725	7	2,411	6	4,606	5	9,768	4	18,147	1	24,000	1	36,292	1	66,193
New Hampshire	8	295	3	250	5	922	9	3,540	7	4,962	6	9,731	3	10,843	2	25,875	0	0	0	0
Vermont	19	760	9	678	7	1,277	3	1,078	9	6,510	9	14,475	4	21,975	3	35,980	2	77,400	0	0
Massachusetts	5	207	3	281	19	3,047	14	5,419	12	9,100	14	23,880	33	170,495	9	150,004	9	293,887	5	469,775
Rhode Island	1	45	1	85	0	0	1	375	0	0	1	1,100	3	14,475	1	14,800	0	0	2	222,550
Connecticut	1	45	2	150	2	327	8	3,180	6	4,800	6	9,640	6	26,281	5	81,600	5	173,774	1	98,925
Middle Atlantic																				
New York	44	1,781	28	2,316	47	7,724	27	19,524	19	14,022	26	45,531	24	118,054	15	233,112	9	369,311	15	3,711,023
New Jersey	6	270	8	630	4	711	7	2,447	4	3,149	3	5,162	3	21,650	2	31,433	1	36,250	1	415,160
Pennsylvania	33	1,472	24	1,915	33	5,834	29	10,781	30	21,861	16	23,309	20	71,599	8	144,115	7	248,356	12	2,399,604
South Atlantic																				
Delaware	1	45	2	155	7	1,250	1	300	1	562	0	0	1	5,125	0	0	1	32,900	0	0
Maryland	11	423	6	479	9	1,447	6	2,337	4	2,700	1	1,130	1	5,000	2	36,000	1	36,400	2	449,600
Dist. of Columbia	0	0	0	0	1	120	0	0	0	0	0	0	1	3,000	0	0	0	0	1	121,000
Virginia	16	628	6	514	21	3,203	10	3,975	3	2,196	5	6,544	9	48,273	3	42,187	0	0	1	131,425
West Virginia	12	481	10	866	12	2,466	3	1,360	10	7,411	3	4,700	5	29,347	2	25,250	0	0	5	509,646
North Carolina	25	1,098	24	1,917	34	6,392	20	7,556	15	12,076	14	22,826	6	39,365	6	103,067	0	0	3	816,366
South Carolina	12	499	8	680	20	3,698	13	4,657	8	6,311	3	5,312	7	36,995	2	28,825	1	47,799	1	82,500
Georgia	22	802	38	3,076	34	6,055	26	10,061	14	10,748	10	14,565	6	33,150	3	55,798	1	29,207	2	370,893
Florida	17	598	9	785	22	3,471	19	7,355	15	11,020	8	10,745	7	31,996	1	12,625	2	57,750	0	0
East North Central																				
Ohio	56	2,199	32	2,595	49	8,844	41	15,190	30	22,651	15	23,177	11	55,731	7	111,353	2	60,625	11	1,449,982
Indiana	51	1,975	26	1,943	27	4,628	20	6,916	18	12,229	13	27,957	12	63,793	5	75,805	10	328,256	2	160,000
Illinois	57	2,079	40	3,290	42	7,145	32	12,142	19	13,212	12	19,068	10	69,080	8	133,181	8	278,100	7	1,446,134
Michigan	30	1,164	23	1,790	43	7,291	25	8,907	14	9,821	16	25,733	13	64,356	3	46,000	1	43,750	3	809,575
Wisconsin	63	2,617	30	2,414	47	7,571	27	9,649	19	13,282	15	24,924	8	45,622	4	61,310	5	156,925	4	598,851
West North Central																				
Minnesota	63	2,569	23	1,689	59	9,873	19	7,137	19	14,582	10	15,116	6	26,652	4	55,538	0	0	3	257,303
Iowa	60	2,602	27	2,183	38	6,761	21	7,566	14	9,623	13	20,648	12	68,765	5	88,918	2	77,607	3	285,190
Missouri	57	2,171	17	1,215	37	6,359	21	7,594	12	9,184	9	13,937	8	44,577	4	63,810	1	30,225	3	395,672
North Dakota	88	2,828	32	2,448	25	3,858	6	1,841	4	3,090	2	3,175	2	14,907	0	0	0	0	0	0
South Dakota	44	1,655	19	1,365	16	2,594	6	2,148	6	3,792	3	4,175	1	7,350	2	35,454	0	0	0	0
Nebraska	91	3,430	44	3,439	58	9,684	22	7,415	7	5,721	11	18,881	3	15,481	2	38,212	0	0	1	86,500
Kansas	63	3,445	24	1,902	56	9,858	28	9,186	20	13,103	11	18,989	7	36,973	2	41,561	3	99,485	0	0
East South Central																				
Kentucky	21	702	24	1,890	19	3,367	10	3,249	2	1,230	4	7,355	4	25,258	4	61,302	1	28,920	1	115,653
Tennessee	16	648	11	881	13	2,058	17	6,544	8	6,427	3	5,617	5	20,098	2	25,625	0	0	1	54,356
Alabama	8	371	9	808	9	1,430	17	6,440	5	3,908	4	7,300	3	17,210	2	25,118	0	0	1	496,900
Mississippi	8	313	15	1,145	20	3,655	15	5,171	6	4,753	2	4,325	1	2,900	2	37,052	0	0	0	0
West South Central																				
Arkansas	15	1,534	16	1,224	19	4,004	12	4,517	6	3,894	2	4,152	4	16,440	3	47,125	1	36,503	0	0
Louisiana	10	351	15	1,307	16	2,809	20	7,732	3	1,869	4	8,715	4	18,815	0	0	0	0	1	104,875
Oklahoma	20	738	18	1,410	37	6,697	20	6,771	16	10,786	5	9,344	3	13,540	4	71,870	0	0	0	0
Texas	51	1,915	32	2,455	59	10,533	44	16,342	18	13,569	20	29,713	18	66,501	4	74,525	3	162,045	3	265,709
Mountain																				
Montana	13	413	7	431	10	1,760	7	2,740	6	4,231	3	5,307	2	6,997	0	0	1	35,000	1	281,250
Idaho	15	620	5	432	8	1,532	7	2,442	5	3,700	6	10,830	2	6,736	1	10,415	0	0	1	57,410
Wyoming	7	216	6	499	10	1,877	3	1,250	9	7,214	3	5,950	2	8,375	1	12,937	0	0	0	0
Colorado	12	453	14	1,457	20	3,674	12	3,693	4	2,280	9	14,850	2	13,475	3	54,409	3	95,235	0	0
New Mexico	1	15	3	270	7	1,111	7	2,514	2	1,769	3	3,388	2	7,611	0	0	0	0	0	0
Arizona	3	145	4	292	5	930	7	2,333	7	5,325	2	3,050	3	16,255	2	28,270	1	36,310	0	0
Utah	6	275	7	562	12	1,996	3	1,302	5	3,702	4	6,125	2	4,500	0	0	0	0	1	240,121
Nevada	2	90	1	75	4	1,040	1	270	2	1,462	3	4,405	1	3,125	1	10,750	0	0	0	0
Pacific																				
Washington	25	979	13	1,055	9	1,399	10	3,565	6	4,867	5	9,450	5	23,240	3	40,659	1	39,000	5	582,659
Oregon	7	263	4	307	9	1,248	6	2,166	5	3,984	6	10,413	1	3,505	3	43,287	1	47,000	1	106,912
California	6	232	9	780	11	1,937	9	3,487	9	6,827	11	18,468	7	34,718	2	29,342	4	165,825	9	1,692,290

Trends in Power Generation*

Size of Units Shows Increase—Voltage for Auxiliary Equipment—Life Period of Station a Basic Factor in Their Design—Process Developments Promising —Higher Pressures and Temperatures Used

IMPORTANT technical developments in the art of power generation during the past year may be summarized as follows:

1. A 3,000-kw., 1,200-lb. boiler and turbine has been operated successfully by the Edison Electric Illuminating Company of Boston. More than 1,800 hours of commercial operation has been had, and data show that fuel consumption of the station would be reduced 10 per cent, or to 0.9 lb. of coal per kilowatt-hours, if all boilers were of the high-pressure type.

2. Successful operation of stations using the reheating cycle and steam at 550 lb. and 725 deg. temperature has been had. Indications are that such stations as Philo (Ohio Power Company), Twin Branch (Indiana & Michigan Electric Company), and Crawford Avenue (Commonwealth Edison Company) may be counted on for thoroughly satisfactory and reliable service. A total of 900,000 kw. of station capacity for operation at 550 lb. is now in operation or being installed.

3. The size of generating units continues to increase. At Crawford Avenue, Chicago, a 77,000-kw. and a 90,000-kw. unit has been purchased, and an 80,000-kw. unit has been bought for Hudson Avenue, Brooklyn. Units of 200,000 kw. capacity are contemplated for the new State Line station near Chicago, and a unit of 160,000 kw. capacity has been ordered for Hell Gate station in New York.

4. The Fuller well-type furnace for turbulent pulverized-fuel firing has been placed in operation under an 11,400-sq.ft. boiler in the River station of the Buffalo General Electric Company, and three more units of this type are being installed.

5. The processing of coal is being tried out on a large scale by the Milwaukee Electric Railway & Light Company. This is a low-temperature carbonization process giving pulverized fuel as residue for use in the station boilers.

TRENDS IN STATION DESIGN

A study of individual achievements and of the principles of design now used in stations shows several trends:

1. The heating of the feed water to a temperature of from 350 deg. to 400 deg. F. by means of steam bled from three or more stages of the turbine.

2. The use of air heaters to absorb heat from flue gases and return it to the furnaces.

3. The elimination of the economizer.

4. The widespread use of steaming surface for furnace walls and the reduction in amount of furnace brickwork.

5. The use of automatic control in boiler rooms with consequent better day-to-day efficiency.

6. The use of separate ventilating fans in connection with generators of 65,000 kw. capacity and larger.

7. The use of relatively smaller and better-designed condensers.

DEVELOPMENTS IMMEDIATELY AHEAD

The present combination of boilers and water-cooled furnaces, which are, as one engineer expressed it, "fearful and wonderful jobs of plumbing," probably forecast certain changes in boiler and furnace design which will result in simplification and decreased investment, while at the same time maintaining what appears to be the most logical development of the boiler surrounding the furnace. The industry is probably on the verge of being forced into the use of higher voltages in connection with the very large generators now contemplated.

Two phases of the auxiliary power supply problem are worthy of study by the members of the Institute:

1. Is the use of 2,300 volts for distribution to station auxiliaries the best choice, involving as it does the use of expensive oil-immersed switching equipment occupying valuable space? The alternative is a voltage of the order of 440 and the substitution of carbon circuit breakers and contactors for oil switches. This alternative offers distinct advantages from the standpoint of reduced investment in equipment and in building and in greater ease of inspection and maintenance.

2. What is the best solution for variable-speed drive of the forced-draft and induced-draft fans in new stations? The difficult nature of the problem is exemplified by an installation in one of the new stations now being built: Two 200-hp. motors drive the forced-draft fans of each boiler and two 550-hp. motors drive the induced-draft fans of each boiler. The speed of the fans must be varied by 50 steps through a range from seven to one, and the total horsepower input to the four fans varies from 1,500 hp. to 15 hp. In this case the motors for the fans in connection with one boiler cost approximately $12,000, and the electrical control equipment for these motors cost approximately $20,000 and occupied a lot of rather expensive space. If electrical engineers cannot work out a simpler and less costly solution for this admittedly difficult problem, power-station designers may have to return to the use of steam turbine drive for these, much as they may wish to avoid this solution with its attendant use of reduction gears.

The use of higher steam temperatures of the order of 800 deg. F. and perhaps as high as 900 deg. F. is being forecast by scattered operating experience, most of it unpremeditated. Owing in the main to errors in superheater design, the steam temperatures in some of the new stations have been higher than was anticipated. some of these stations have operated for appreciable periods of time with steam temperatures in excess of 775 deg. F. One turbine operated for a time with steam at a temperature of approximately 1,000 deg. F.

*Abstract of report of power generation committee of the A.I.E.E., presented at White Sulphur Springs, W. Va., June 25, 1926. This is a preliminary report of the power generation committee prepared by the chairman, V. E. Alden, for presentation at the annual meeting of the Institute. The final report is subject to revision and approval by the committee and will be published by the Institute.

There have been no serious indications of distress as a result of operation at these high temperatures. It has just been reported in the technical press that a 40,000-kw. turbine in the Gennevilliers station in France operated for 135 hours during the months of October, November and December of last year with steam at temperatures ranging from 775 deg. to 914 deg. F. An inspection made Dec. 25 showed no indications of deterioration of the parts in contact with high-temperature steam. The turbine was returned to service and has continued to operate satisfactorily with steam at temperatures varying all the way from 700 deg. to 900 deg. F.

These experiences, together with the experience gained in the operation of oil stills, tend to show that the attractive possibilities incident to the use of steam temperatures considerably in excess of the present accepted limit of 750 deg. F. may be availed of.

Attention of the committee had been called to three examples of the broad general solution of power supply by the combined use of steam generating stations and water-power plants. These examples are:

1. The construction of the 350,000-hp. hydro-electric plant at Conowingo for power supply to Philadelphia.

2. The construction of a new 70,000-kw. steam generating station by the Southern Power Company.

3. The completion of a 128,000-kw. addition to the Long Beach steam station of the Southern California Edison Company and the starting of work by the same company on a new station of at least 600,000 kw. ultimate capacity with an initial development of 150,000 kw.

Operating Reliability and Margin of Spare Capacity

Studies have been made jointly by a number of the operating companies of this country having for their purpose the determination of the operating reliability of large generating units. An analysis of the operating records covering the calendar year of 1925 for 191 turbines aggregating 5,627,000 kw. capacity showed that on an average these machines were in service 65.1 per cent of total hours in the year and that they generated 44 per cent of the maximum possible number of kilowatt-hours. They were idle but not needed 21.25 per cent of the hours in the year. For 13.63 per cent of the hours in the year, however, these machines were out of service for overhauling, inspection, maintenance work and cleaning, these outages being allocated as shown below:

	Per Cent
Turbine outage	7.29
Generator outage	1.85
Surface-condenser outage	3.51
Other causes	0.98
Total outages	13.63

Comparing the foregoing results with the results of similar analyses made during previous years covering operation for the period from 1914 to 1923, inclusive, three things show up in striking fashion:

1. There is little, if any, evidence to indicate the decrease which one would like to see from year to year in turbine outages.

2. Prior to 1923 the generator outage averaged 2.8 per cent of the hours in the year. For 1923 and 1925 the generator outage has averaged 1.8 per cent. This is concrete evidence as to what the generally adopted closed system of ventilation has accomplished.

3. The surface condenser outage has increased from 1.2 per cent to 3.51 per cent of the total hours in the year. This increase perhaps serves as an index of pollution of the water in our rivers and harbors.

When consideration is given to the fact referred to above, that the outages due to causes other than the turbine, the generator and surface condenser aggregated only 0.98 per cent of the total hours in the year, and that the relative importance of this item is only 7 per cent that of the outages due to other causes, there arises reason for reflection. On an average the investment in the turbine room with its equipment is only 40 per cent of the total investment in the station. Yet 93 per cent of the outages of station capacity are chargeable to the turbine room. Perhaps there has been a failure to strike the proper balance between installed capacities, with their corresponding investments in the turbine room and in the boiler house with its related coal-handling equipment.

Turning to a consideration of waterwheel-driven generators, a result of an analysis made by the hydraulic power committee of the National Electric Light Association shows that total outage time on these units is appreciably less than on steam turbines. The analysis covered the operating records for 1924 on 56 waterwheels, aggregating 950,000 hp.

These machines were in operation 77 per cent of the hours in the year and generated 48.1 per cent of the maximum possible number of kilowatt-hours. They were idle but not needed for service 17.62 per cent of the total hours in the year and were out of service for 5.4 per cent of the total hours in the year for reasons indicated below:

	Per Cent of Hours in Year
1. General hydraulic causes	0.64
2. Waterwheels and auxiliaries	3.01
3. Generators and appurtenances	1.55
4. Electrical causes beyond the generator related to switching equipment and outside transmission	0.2
Total outages	5.40

Outage time is related directly to the needs for spare capacity, and the fixed charges on spare capacity constitute perhaps as much as 10 per cent of the total annual cost of power generation in steam-generating stations. It is essential to find ways of reducing this item of cost. A portion of this burden must be carried by the equipment manufacturer. He must build equipment that will be capable of operation for all except a very few hours per year. Particularly must he guard against any inherent weakness which will cause trouble involving unexpected shutdowns, even though these outages be of short duration. Much can be accomplished by the engineer who designs the power station in foreseeing and eliminating certain features which may constitute the cause of an outage. The operating engineer can do much to control the necessary margin of spare capacity by the choice of the best operating methods, the careful training of personnel and by the careful scheduling of inspection, preventive maintenance and cleaning. With careful planning a large percentage of outage time can be made to occur when the capacity is not needed for service.

Old Station Disposition

One of the most troublesome problems facing the executives of large electric light and power companies today is what to do with the old steam generating stations. Many of our large companies have from 100,000

kw. to 250,000 kw. of capacity in steam generating stations in connection with which the coal consumption per kilowatt-hour generated is 2 lb. or higher. The costs of labor and maintenance are high. Viewed from the standpoint of operating costs (not including fixed charges), it seems nothing short of a crime to generate power in these stations, bearing in mind that the modern stations being operated by these same companies will generate power for slightly in excess of 1 lb. of coal and with much lower costs for operating labor and maintenance.

Opportunity for Rebuilding

There is, of course, the possibility in some cases of rebuilding, in part at least, so as to improve the station performance. Notable examples of such programs of rebuilding are exemplified by the substitution of unit coal pulverizers for the obsolete stoker equipment in the Brunot's Island station in Pittsburgh and the Ashley Street station in St. Louis. Some executives raise the objection that such a procedure in connection with their stations would be sending good money after bad.

It is not the purpose to discuss this question of "What shall we do today with our old stations?" but rather to ask "What of the stations being built today in relation to our operating problems of 20 and 30 years from now?" Assume, for example, that a company which had a system load of 400,000 kw. in December, 1925, placed in operation this year the initial 50,000-kw. unit of a 300,000-kw. steam generating station. Assume that the average annual load growth is 9 per cent, that the yearly load factor is 56 per cent and that the shape of the load duration curve is typical of load conditions in almost any one of the large cities on the Atlantic seaboard. An additional 50,000-kw. turbine must be installed each year until 1931, when the station will be completed. Since the station will be half completed in 1929, the beginning of its useful life may be taken as of that date. If conventional lines of thought are followed, the useful life of this station will be assumed to extend from 1929 to 1949. What shall be done with this station in 1949? Conceivably the new stations being built in 1949 may generate power for 9,000 B.t.u. per kilowatt-hour, whereas the very best the hypothetical station started in 1926 can do, even on a good load factor, is 14,500 B.t.u. per kilowatt-hour.

Use Factor Decreases

The system load has grown, however, from 400,000 kw. in 1925 to 3,185,000 kw. in 1949. As the result of the inevitable law which pushes the old station a little higher each year into the peak of the load duration curve, it is found that the 300,000-kw. station will in 1949 generate only 300,000,000 kw.-hr., corresponding to an annual use factor of 11.4 per cent. As the result of the low load factor, the B.t.u. per kilowatt-hour has been pushed up to 17,000. The annual coal consumption is 190,000 tons, and the annual fuel cost is, say, $1,300,000. By scrapping this station and substituting in its place a modern station of the 1949 vintage the annual fuel cost in connection with the 300,000,000 kw.-hr. of generation carried by this station can be reduced from $1,300,000 to $800,000, with an annual fuel saving of $500,000. Few would dare to predict that this 300,000 kw. of new capacity of 1949 vintage will cost less than $18,000,000, or that the investment bankers of that day will be willing to finance new construction work at rates which would permit the increase in fixed charges incident to the construction of the new station to be less than $2,200,000.

The major increase in load on most of the larger systems comes about as a result of increase in load density. Consider, therefore, the strategic position which the station built in 1926 will probably occupy with respect to the load as of 1949 or 1959.

It would appear that the engineers and executives of 1949 are going to have a very difficult time justifying the scrapping of the 300,000-kw. station of 1926 vintage. Such a step will be even more difficult to justify in 1959, for by that time the annual fuel cost in connection with this station will have dropped from $1,300,000 as of 1949 to approximately $125,000 per year, corresponding to an annual station use factor of 1 per cent. The function of this station will have changed from that of generating kilowatt-hours to one of supplying kilowatts of capacity. The foregoing analysis, it must be understood, is based not on this station being held merely in reserve, but on its carrying its proportionate share of the system peak load.

Design for Long Use

This analysis rather places the burden of truth on the engineers to show good reasons why they should not design stations on the basic assumption that they will be used and useful, not merely for a period of 20 years, but for 100 years, 200 years or until such a time as the use of electrical energy as related to the life of our large cities and our nation has become no longer necessary.

This statement is not to be construed as an argument for the doing away of renewal reserves. Sound business principles indicate the advisability of accumulating ample renewal reserves. It is intended to make the engineer who lays down the design of a new generating station ask himself certain questions:

1. Is the equipment well adapted to the load conditions which will obtain in connection with this station after it has become 20 or 30 years old? These load conditions will involve starting and stopping all turbines in the station twice each day and the picking up of big blocks of load at a rapid rate. The boilers must be banked frequently and they must be able to pick up load quickly.

2. Is the design of the station such that the costs of operating labor and maintenance will be reasonable? In the example outlined above the cost of operating labor and for maintenance after 1955 will exceed the cost of coal and in 1959 will be at least five times the cost of the fuel. During its first 100 years of life this hypothetical station will probably burn $90,000,000 worth of coal and require the expenditure of $80,000,000 for operating labor and maintenance. Consider the tremendous advantage in connection with this type of operation which stations of consistent design with duplicate units of interchangeable parts would have.

3. Will it be necessary, solely from the standpoint of being able to install more kilowatts of station capacity on the available ground area, to do a costly job of rebuilding in the future? Perhaps the very policies now being pursued by some companies in building stations in which extra space is provided in the initial section of the station, so that later units installed may be increased in size, is laying the groundwork for an expensive rebuilding job 20 or 30 years from now.

4. With the changed conditions which will exist fifty or a hundred years from now and with the city pressing in on the station from all sides, will the company still be able to live peacefully with its next-door neighbor?

5. Is the station design such as to form the proper economic balance as between fixed charges and operating costs on the basis of one hundred or even two hundred years' life?

These and a host of other questions press for answers the moment one admits the possibility that the aforegoing analysis may be correct. Perhaps power-station engineers and the executives making decisions bearing on power-station design had better try to find the answers to some of these questions. If they do not, they will probably be cordially damned by the men of the coming generation who will carry on this work.

Reduced Pulling-In Tensions on Cables

Improvement in Transmission Cables Requires Equal Betterment of Installation Practise —Studies on Pulling Tensions for 132-Kv. Cable in Monolithic Ducts Reveal Great Reductions Through Use of Soapstone

By CARROLL H. SHAW
Engineer of Distribution and Installation Department New York Edison Company

THE extreme precision and care that must be exercised in the manufacture of transmission cables for 60,000 to 132,000-volt circuits has been reflected in the construction of the conduit lines in which these cables are to be installed. The hot and cold bending tests that are specified for the cables have shown the importance of reducing the tearing of the insulating paper and have called attention to the desirability of limiting the pulling stress on cables during installation to the lowest possible values.

When construction began for the conduit line that is to carry the 132,000-volt circuits of the Edison-United Companies from New York City to the Dunwoodie substation in Westchester County, it was considered desirable to limit the length of sections between manholes to not more than 400 ft. in order to be certain that too heavy pulls would not be required to get the cables into the ducts. Special care was taken to eliminate bends in the duct line by locating manholes at all points where important changes in direction occurred. This conduit line consists, on the northerly end, of nine 4-in. ducts in 3x3 formation and has been constructed entirely of Murray monolithic concrete, using both rubber forms and machines, as conditions required.

After the ducts were completed, a test cable was installed in at least one of the nine conduits in every section, and where the pulls were found to be excessive other ducts in the same bank were tested to make certain that no fault or break had occurred in the line. Of the 60 sections tested, only one was found to show an excessive tension and to require repairs.

A new design of continuous reading dynamometer rig was developed to facilitate the installation of these test-cable sections, a diagrammatic sketch of its use on a cable truck being shown in Fig. 1. This equipment has been designed for operation on cable installation trucks, using a drum-type winch and not a "nigger-head." When not pulling in cable the steel rope is readily unshipped and no appreciable delay in the normal routine work of the cable gang occurs. An engineer is assigned to read and record the pulling stresses, which are usually measured at each 20-ft. point. The dynamometer has been calibrated for direct reading and a distance register that indicates the length of cable installed is operated by means of a cam on the side of one of the pulleys, which is constructed so as to make one revolution per foot of progress.

A great many experiments were conducted to reduce the friction of the cable in the duct. Subway grease was applied to the cable by the usual method at the feeding end and was also forced through a flexible pipe so as to lubricate the entire length of duct. The results

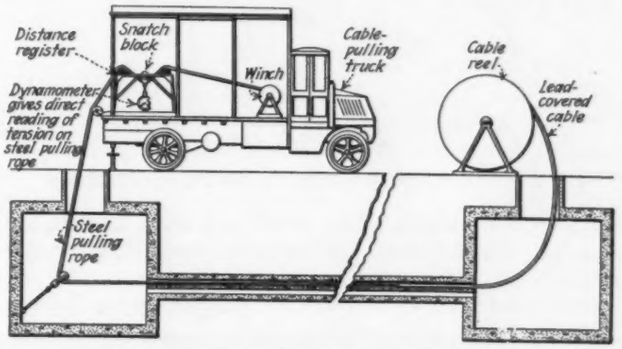
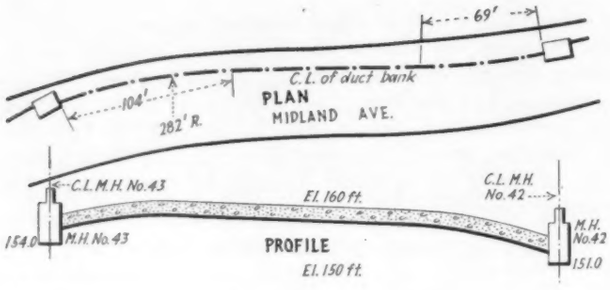


FIG. 1—SET-UP OF CABLE-PULLING EQUIPMENT

of the work with grease in reducing friction were quite successful, as the pulling tension was reduced approximately 50 per cent where the duct was greased throughout, but the process of getting the grease into the ducts was found to be very slow and expensive, since 1,700-lb. pressure was found necessary to force ordinary heavy "subway" or "cable" grease through the 400 ft. of flexible pipe. This made necessary the use of a motor-driven, high-pressure grease pump with storage battery truck and crew in attendance.

Efforts were then directed toward the use of pulverized soapstone, which has been used sporadically for many years on cable installation. It was recognized, with soapstone as well as with grease, that the value of the lubricant lay in getting it into the duct throughout its length, as tests had shown a marked decrease in pull in the entirely greased line as compared with that in which the grease is fed in with the cable without any assurance of keeping the forward end sufficiently lubricated.

In all the tests with lubricants the test cable had been installed in the same ducts first without any form of lubricant so that the subsequent tests could be of a



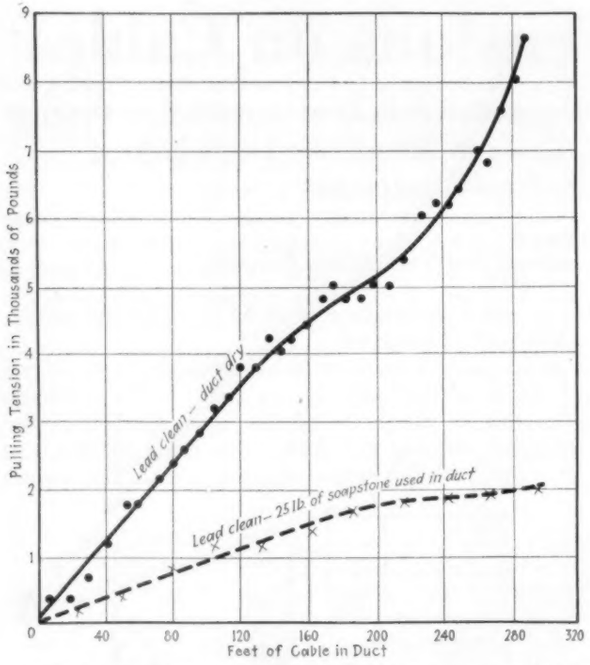

Pulling Tension in Thousands of Pounds
Lead clean — duct dry
Lead clean — 25 lb. of soapstone used in duct
Feet of Cable in Duct

FIG. 2—PULLING-IN TENSIONS IN 280-FT. DUCT SECTION

comparative nature. The ducts had been thoroughly cleaned and brushed before any installation work started.

A scheme was worked out for distributing a reasonably uniform quantity of powdered soapstone throughout the length of the duct and in the ducts where comparative tests have been made it has been found that an extraordinary reduction in tension has been secured, particularly in the ducts that originally indicated the heaviest pulls. For example, Fig. 2 shows the tension on the cable when pulled first without and then with soapstone into a 280-ft. section of conduit which contained a slight reverse curve in plan with a dip at both ends in elevation. The pull on the bare cable in the dry, clean duct reached 8,600 lb., but after an application in the duct of 25 lb. of soapstone, the maximum pull fell to 2,025 lb., or less than 24 per cent of the first figure.

In another case of a comparatively straight run 400 ft. long, the unlubricated pull registered 4,600 lb., whereas after an application of 35 lb. of soapstone, the maximum pull was only 1,800 lb. (Fig. 3). In a third case, under similar conditions, the reduction was from 6,400 lb. to 2,050 lb. (Fig. 4).

There are several important advantages derived from the use of powdered soapstone with the methods that have been developed:

1. Friction between cable and conduit is greatly reduced throughout duct.
2. The reduction in friction can be obtained without any extra operations.
3. Soapstone is much cleaner and easier to handle than grease.
4. The process costs almost nothing and soapstone itself is very cheap.

In conclusion it may be said that if the possibilities of using soapstone so successfully had been known in advance, it would have been entirely practicable to build many of the subway sections at least 500 ft. long, rather than 400 ft., thereby saving several manholes and eliminating a number of sets of very expensive 132,000-volt splices. As a tension of 5,000 lb. appears to be entirely satisfactory to all cable manufacturers, it is evident that the proper use of powdered soapstone will, in general, permit the installation of cables at stresses well below the maximum desirable figures.

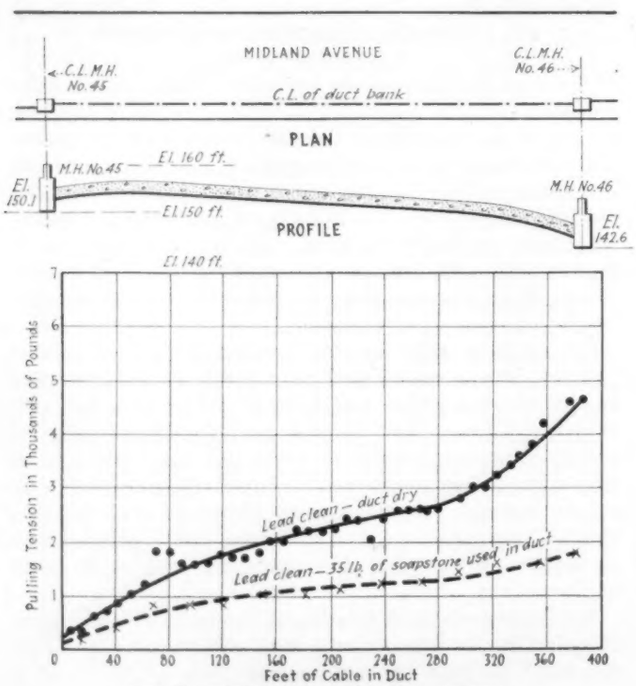


FIG. 3—TENSIONS IN 400-FT. SECTION

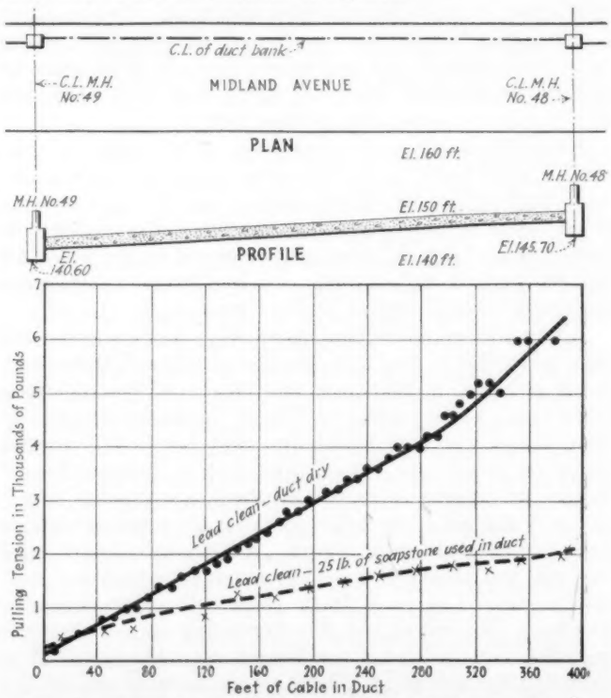


FIG. 4—TENSIONS IN 400-FT. SECTION, SIMILAR TO FIG. 3

Central Station and Industrial Practice

Use of Creosoted Pine Poles Increasing

AT THE recent convention of the Southwestern Geographic Division of the National Electric Light Association at Galveston, Tex., H. E. Braunig, superintendent of transmission and distribution for the Eastern Texas Electric Company of Beaumont, Tex., presented as a part of the report of the overhead lines committee, Technical Section, a paper calling attention to the marked expansion in the use of creosoted pine poles throughout the country and to some of the advantages which they have been shown to possess.

Mr. Braunig summarized his report as follows:

1. *Strength.*—Pine is the strongest of the pole woods. Its strength is lasting, there apparently being no reduction even after long periods of service. This fact has its application in the use of smaller poles or fewer poles per mile in creosoted pine construction.

2. *Life.*—Variously estimated as being from 25 to 40 years. Ultimate average not yet definitely established.

3. *Conductivity.*—Not increased by creosoting.

4. *White Ants.*—Most resistant of wooden poles, due to deep penetration of creosote, which is a toxic to white ants.

5. *Fire Resistant.* — Studies have shown creosoted pine poles resistant to fire. References named in the bibliography cite examples of lines showing this property of fire resistance.

6. *Use.*—Increasing rapidly in all kinds of service.

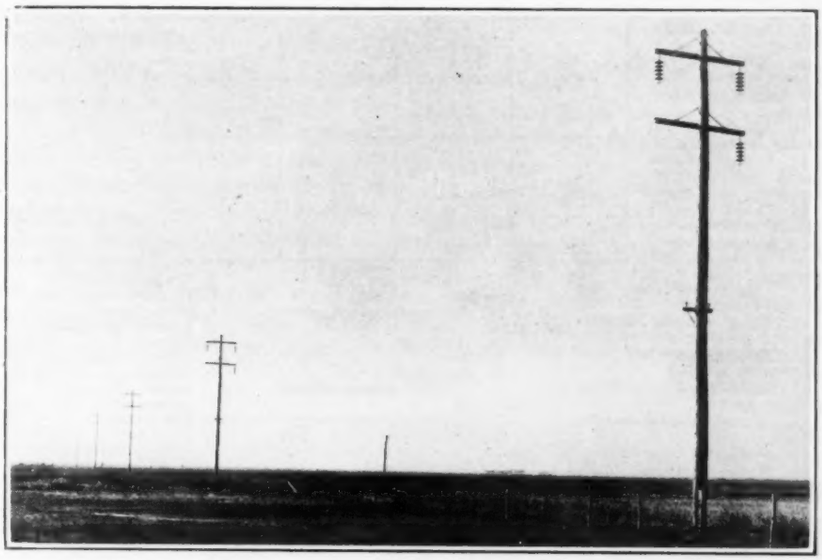
7. *Cost.*—The results of available cost studies differ widely for different companies, but are uniform in showing pine as most economical, when compared with poles or other kinds, for usual types of service.

The committee said that no tests or experimental work were found necessary, inasmuch as there had been numerous previous tests conducted, and that its work consisted largely in the summation of recent authoritative data on the subject and the compilation of the accompanying bibliography.

A fact of great importance reported was that creosoted pine maintains its strength over a long period, all evidence indicating that as long as the wood is preserved against decay the original strength is undiminished. Portions of the report dealing with a recent experience of the Eastern Texas Electric Company are quoted as follows:

"We had a striking example of this at Beaumont on March 30, when a cyclone hit in that vicinity. The wind attained a velocity of 110 miles an hour and, owing to the flat, open country, there was nothing to break its force. Damage of all descriptions within the city limits of Beaumont alone amounted to one-half million dollars. Our properties were in the midst of this storm, and though a great many wires and some 50-odd poles were broken, there was not a single broken creosoted pine pole—this in spite of the fact that some of the lines were installed as far back as 1911 and were in the direct path of the storm.

"One section of our Beaumont-Liberty 66,000-volt transmission line was in the direct path of this storm and at right angles to it, and although some of these poles were blown over to an angle of approximately 40 deg. and some of the conductors broken because of the lack of guys, there was not a single broken or split creosoted pole in this section. This line is constructed on 55-ft. creosoted poles, and a section of same is shown in the picture. We feel that this was entirely due to the strength of the creosoted poles, inasmuch as practically everything in the path of the storm, which blew approximately 110 miles an hour in this section, was wrecked, trees being uprooted and twisted and houses being demolished."



BEAUMONT-SOUR LAKE 66,000-VOLT LINE
One of the lines of the Eastern Texas Electric Company in path of 110-mile wind. No poles damaged.

BIBLIOGRAPHY OF DATA ON CREOSOTED LINE POLES

1. **Tests on Pole Strength.** By American Telephone & Telegraph Company, 1924. (These results have not yet been published. They are to be presented at a later date before one of the engineering societies.)

2. **Results of Some Strength Tests on Wooden Poles.** By T. R. C. Wilson, United States Forest Products Laboratory, Madison, Wis.

3. **Southern Pine Poles.** 1923 Report of Overhead Systems Committee. Pennsylvania Electric Association, Eastern Geographic Division, N.E.L.A.

4. **Characteristic and Cost Data.** April 1, 1925. By Distribution Department, Carolina Light & Power Company.

5. **Report of Inspection of Preservative Treatment, Dallas-Sherman Toll Pole Line, 1921.** Southwestern Bell Telephone Company.

6. **Wood-Preserving News.** September, 1925.

7. **Report of Conductivity Committee.** Proceedings of American Wood Preservers' Association, 1923, pp. 362-363.

8. **Tests of Methods of Protecting Woods Against Termites or White Ants.** United States Department of Agriculture Bulletin No. 1231. By Thomas E. Snyder.

9. **The Fire Hazard of Treated Timber.** Proceedings of American Railway Bridge and Builders' Association, October, 1924, pp. 152-153.

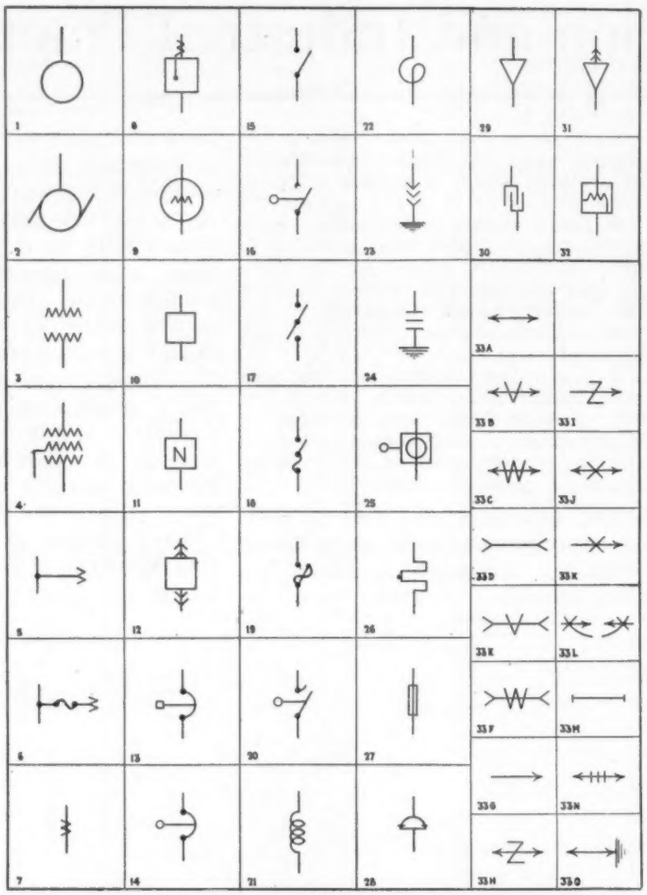
10. **The Creosoting Industry with Relation to the Fire Hazard.** Quarterly of the National Fire Protection Association, April 1918, pp. 399 to 413.

11. **Quantity of Wood Treated and Preservative Used in the United States in 1923. Ibid, 1924.** Published by R. K. Helphenstine, United States Forest Service, in cooperation with American Wood Preservers' Association.

12. **Report of the Suitability of Concrete Poles for Use by Light, Power and Street Railway Companies.** By C. V. Merriam, Eastern Texas Electric Company, Beaumont, Tex.

Symbols for One-Line Wiring Diagrams

THE symbols shown here were taken from a serial report of the electrical apparatus committee of the National Electric Light Association. They, with many others, are suggested by the committee. The symbols illustrated are the ones more commonly used in electrical drawings. They are named as follows:



1. Alternating-current rotating apparatus.
2. Direct-current rotating apparatus.
3. Two winding transformer.
4. Three winding transformer.
5. Potential transformer.
6. Fused potential transformer.
7. Current transformer.
8. Bushing-type current transformer.
9. Induction regulator.
10. Automatic oil circuit breaker.
11. Non-automatic oil circuit breaker.
12. Truck-type oil circuit breaker.
13. Solenoid-operated air circuit breaker.
14. Motor-operated air circuit breaker.
15. Single-throw single-blade disconnecting switch.
16. Motor-operated disconnecting switch.
17. Rotary-blade disconnecting switch.
18. Fused disconnecting switch.
19. Disconnecting fuse.
20. Motor-operated horn-gap air-break switch.
21. Reactor.
22. Choke coil.
23. Electrolytic lightning arrester.
24. Valve-type lightning arrester.
25. Motor-operated rheostat.
26. Resistor.
27. Shunt.
28. Rectifier.
29. Non-disconnecting pothead.
30. Static condenser.
31. Disconnecting pothead.
32. Compensator.
33. Different types of relays, which are as follows:
    a. Overcurrent.
    b. Overvoltage.
    c. Overpower.
    d. Undercurrent.
    e. Undervoltage.
    f. Underpower.
    g. Power directional.
    h. Distance or impedance, non-directional.
    i. Distance or impedance, directional.
    j. Differential current.
    k. Differential power.
    l. Pilot wire.
    m. Temperature.
    n. Phase-balance current.
    o. For ground relay application add ground symbol to relay symbol.

Combined Centrifuge-Filter Renovates Oil Dielectric

EQUIPMENT for renovating and reclaiming oil used in transformers and other electrical apparatus has recently been installed by the Public Service Company of Northern Illinois. Heretofore the company's equipment for reclaiming oil which showed a high moisture content or objectionable impurities had been only sufficient to take care of a limited volume of oil. The new oil-treating apparatus is being used entirely for transformer oil, but it is intended to extend its use to the reclamation of oil taken from switches and other apparatus.

The equipment, which has a capacity of approximately 600 gal. of oil per hour, consists of two 1,500-gal. electrically heated tanks for raising the temperature of the oil, a centrifuge separator and an oil filter press. Reclamation of the oil is performed in two operations—one eliminates moisture and most of the foreign substances, such as dirt; the other is only applied when necessary to carry the refining process further.

The oil to be renovated is heated to a temperature of 110 deg. to 140 deg. F., then drawn off into the centrifuge separator, where the moisture and most of the foreign substances are removed. After the oil is separated by the centrifuge and purified to the extent where it will withstand 27,000 volts between 1-in. disk electrodes 0.1 in. apart, it is then drawn off, if found necessary, into the filter press, where the process of renovation is completed.

Tests are made on samples of the oil at different steps of the renovating process. In some instances it is necessary to run the oil through the separator several times before it will stand up under the standard voltage test that is applied, namely, 27,000 volts under standard oil-test conditions.

System Fault Analysis Indicates Points to Watch

ALTHOUGH 4,192 lighting-system faults, resulting in a total outage of 687,404 lamp-hours, reduced the continuity of Chicago's municipal street lighting in 1925 only 0.26 per cent, the analysis of the causes of outages may be of value as indicating what parts of a lighting system demand the most attention. The causes, with their frequency and resulting lamp outage, are given for the 600, 250 and 100-cp. systems. On Dec. 31, 1925, there were 27,336 600-cp. lamps, 13,854 250-cp. lamps and 28,514 100-cp. lamps. Eighty-six per

CLASSIFICATION OF LIGHTING SYSTEM FAULTS

Source of Fault Causing Outage	Number of Cases			Total Lamp-Hours Lost		
	600-Cp.	250-Cp.	100-Cp.	600-Cp.	250-Cp.	100-Cp.
Regulator	23	8	33	4,761	3,436	27,879
Station	32	9	17	16,621	11,160	5,519
Cable	231	130	386	41,505	33,343	56,691
Wire	219	...	.....	28,821	.....	.....
Group transformer	....	16	63	.....	3,765	14,628
Post or pole	22	12	412	2,052	581	60,340
Hanger	143	...	.....	10,017	.....	.....
Lamp drops	295	...	.....	40,122	.....	.....
Binding-post trouble	396	...	.....	48,058	.....	.....
Compensator	46	...	.....	5,536	.....	.....
Transformer films	.....	147	597	.....	3,894	16,877
Socket	.....	5	219	.....	221	26,293
Outside cause	83	8	5	5,217	5,439	1,860
Unknown cause	19	5	9	1,362	1,603	2,368
Not worked on before 12 o'clock	26	8	24	21,575	2,121	7,577
Not worked on after 12 o'clock	418	24	72	137,084	5,965	30,056
Individual transformer	17	...	.....	1,154	.....	.....
Stop lights	1	2	10	24	30	939
Total	1,971	374	1,847	364,819	71,558	251,028
Actual burning time (1,000 hours)	.....	...	.....	112,853	27,098	111,617

cent of the 600-cp. lamps were on aërial circuits, whereas virtually all of the 250-cp. and 100-cp. lamps were on underground circuits. Based on these numbers, the 600-cp. lamp outages due to system faults were 72 per 1,000 lamps and 13.5 hours per unit; the 250-cp. lamp outages were 27 per 1,000 lamps and 5.2 hours per unit, and the 100-cp. lamp outages were 64 per 1,000 lamps and 8.8 hours per unit.

With the 600-cp. system it may be observed that binding posts, cable, lamp drops and wire were responsible, in the order named, for 43 per cent of the outage time. They caused 58 per cent of the outages. In the case of the 250-cp. system, the transformer films and cable were responsible for 74 per cent of the outages, whereas the cable and station were responsible for 62 per cent of the outage time. With the 100-cp. system the transformer films, posts, cable and lamp sockets were responsible in the order named for 87 per cent of the outages. These causes, in addition to the regulators and group transformers, were responsible for 81 per cent of the total outage time.

Roller Conductor Supports Used on Crossing Tower

Center Tower of Two-Span River Crossing Is Furnished with Trolley Frame Conductor Carrier, Which Eliminates Dead-End Construction

BY E. F. PEARSON
Engineer Northwestern Electric Company, Portland, Ore.

IN DESIGNING a 66-kv. overhead line crossing for the Willamette River at Portland, Ore., engineers of the Northwestern Electric Company worked out a unique method of supporting the conductors on the center tower that eliminated the necessity for a dead-end tower. It was decided to permit the conductor to roll free on this tower, and as the aluminum conductor used was too soft to admit of rolling on sheave wheels, a trolley and eyebeam support, as shown in Fig. 1, was designed.

CONDUCTOR HELD RIGIDLY, BUT MAINTAINS BALANCED TENSION

The conductor is rigidly clamped to a four-wheel trolley, and the trolley is supported and permitted to run free on a 7-in. eyebeam 9 ft. in length. This permits the conductor to be rigidly held so as not to damage the aluminum and yet roll free on the suspension tower and maintain a balanced tension in the spans to either side. In case a conductor should break at a dead end, the trolley will run off the end of the eyebeam, but the conductor will not fall, owing to the action of stationary auxiliary aluminum rollers not normally in contact with the conductor.

The trolley and conductor will roll on down into the river until the tension has again become balanced. These aluminum rollers, which may be seen in the illustration, were added so that in case of a conductor break or the shearing of one of the breaking links it would be an easy matter for the line crew to take hold of the conductor and pull it up to tension again. The trolley and eyebeam are inclosed in a sheet-copper housing to prevent the accumulation of ice in stormy weather. The whole trolley arrangement as installed on the tower is shown in Fig. 2.

The crossing is supported by three riveted structural steel towers as shown in Fig. 3, two of which are dead-end towers and the third a center supporting tower erected on Ross Island. The strain tower shown in the foreground is 107 ft. in height above foundations. The center supporting tower and the other dead-end tower are each 175 ft. in height above the concrete foundations.

The height of the towers was based on a minimum conductor clearance of 123 ft. above low-water level over the main river channel, as required by the War Department. The towers are designed to support six conductors or a total of two three-phase circuits, each circuit to consist of three 336,400-circ.mil standard aluminum-cored, steel-reinforced tower cables, each cable having an elastic limit of 11,715 lb. and an ultimate strength of 16,200 lb.

30,000-KVA. CAPACITY

Each circuit is designed for an ultimate capacity of 30,000 kva. at 66,000 volts, three phase, 60 cycles. Only one circuit is installed at the present time.

To allow a liberal flashover safety factor two insulator strings of seven units each were used in a parallel yoke on the dead ends, two suspension strings in parallel on the center tower and seven strain units per string for the jumpers on the strain towers.

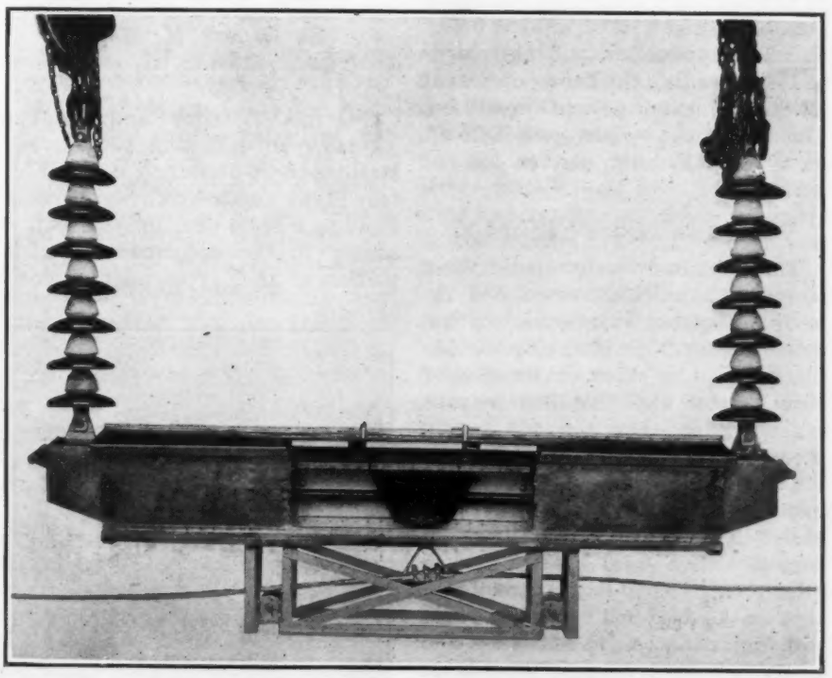


FIG. 1—TROLLEY ARRANGEMENT USED ON CENTER TOWER OF RIVER-CROSSING SPANS TO EQUALIZE TENSION AND AVOID DEAD ENDING

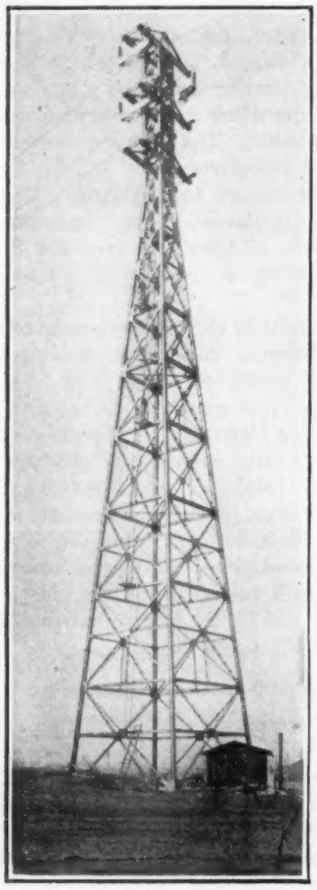


FIG. 2 (AT LEFT)—CENTER SUSPENSION TOWER, SHOWING TROLLEY CONDUCTOR SUPPORTS IN PLACE. FIG. 3 (AT RIGHT)—66-KV. RIVER CROSSING AT PORTLAND, ORE. THE LENGTHS OF THE TWO SPANS ARE RESPECTIVELY 1,135 FT. AND 1,052 FT.

The two span lengths are respectively 1,133 ft. and 1,052 ft., sagged to provide for a maximum loading of ½ in. of ice and 8 lb. of wind at 0 deg. F. The conductors will also carry a 1½ in. radial thickness of ice at 32 deg. F. under no wind condition. The sag in the longer span is 35 ft. at 60 deg. F. with neither ice nor wind.

STRINGING TENSION 2,320 LB.

The computed tension under these stringing conditions was 2,320 lb., and this tension was checked with a dynamometer while stringing. Breaking links under shear constructed of Monel metal were installed on each conductor so that the pin would shear at the approximate elastic limit of the conductor. The towers were designed to withstand an 11,000-lb. maximum tension per conductor with a total of six conductors, giving 66,000-lb. maximum tension on the dead-end towers. Towers and foundations were constructed to withstand this tension in accordance with the City of Portland building code for steel structures.

Designing Substations by Using Models to Scale

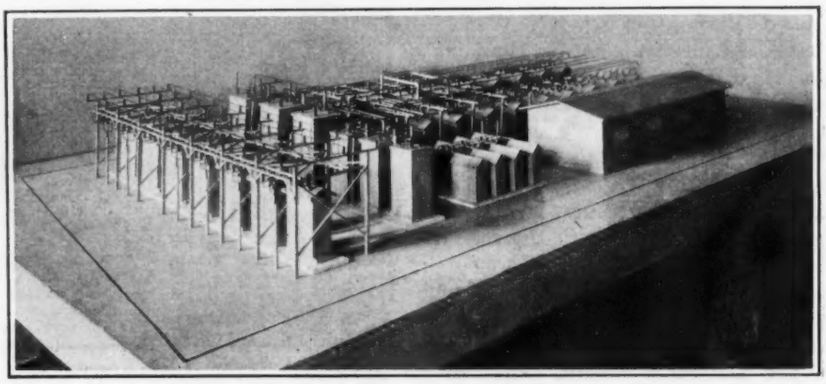
BY GEORGE M. HARDY

General Superintendent Worcester Electric Light Company

TO SAVE time and drafting labor in designing outdoor substations the Worcester (Mass.) Electric Light Company employs models built to a scale of ½ in. per foot, as shown in the accompanying illustration of the layout adopted for a new substation for the Cambridge Street manufacturing district. In the use of these models all structural steel columns, cross-members and braces are of wooden strip pieces cemented (Dupont) together; and oil circuit breakers, transformers, 2,300-volt oil switch, feeder regulator and static condenser housings, as well as insulators and concrete foundations, are made up in the same material. Buses are installed in the form of bare copper tubing. They are also cemented to the wooden insulators.

The installation modeled in the picture will contain when completed three 2,000-kva. and three 1,000-kva. transformers, all single phase and erected in two three-phase banks, fed by three 13.2-kv., three-phase, No. 0000 underground cables. Provision will be made for sixteen 2,300-volt, three-phase underground feeders. In the illustration may be seen at the left the high-tension oil circuit breakers with surrounding bus structure. Next come the transformer banks, and in the background are the 2,300-volt switch houses in two rows, with feeder regulators between. Both main and auxiliary buses are located on the low-voltage side of the substation. The small houses in the middle foreground are for eight 300-kva. static condensers, and the larger building at the right will contain a number of six series mercury arc rectifier outfits automatically operated and two tube transformers.

The model method has been found very useful, as it enables many different arrangements of equipment, clearances, etc., to be studied with minimum delay, and in this company's experience a number of changes have been indicated and made in the design work that might not have been detected as desirable from drawings only.



9,000-KVA. OUTDOOR SUBSTATION SHOWN ON 40X85-IN. MODEL LOT

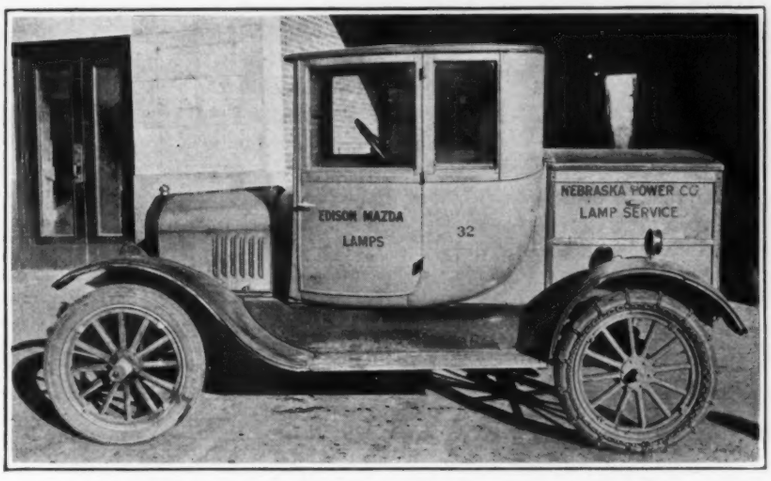
Commercial Activities and Public Relations

Home-Lighting Service Runabouts Used in Omaha

TO RENDER service in home lighting to its customers the Nebraska Power Company, Omaha, has been operating customer-service runabouts for several months with a sales representative as operator. Customer-to-customer calls are made in the runabout and special calls are picked up by telephone en route. Being equipped with a tool-kit for making minor repairs and a complete stock of standard wattage lamps, the driver can ask the customer if any equipment is out of service, if new lamp bulbs are needed or if any advice on lighting the home is wanted. With this introduction, he can obtain an entrée to correct conditions that may be inconveniencing the customer or losing revenue for the company. Many times empty lamp sockets or nearly exhausted lamps are found for which lamps can be supplied. Advice on decorative lighting often leads to sale of additional lamps and increased revenue from energy used. Major repairs are referred to the service department and the equipment needing repair taken there if the customer wishes.

In general, this service has been found very beneficial in building good will, nipping complaints in the bud, filling lamp sockets and increasing revenue.

"Lamp Service" and the company's name are painted on the runabout, which is equipped with compartments to accommodate different size lamps.



RUNABOUT USED IN RENDERING HOME-LIGHTING SERVICE

Minor Radio Interference by Power Company

ONLY 26 cases out of 281 investigated (less than 10 per cent) showed that the company's equipment was causing interference in radio reception in Dayton and vicinity, according to a report just compiled by Karl H. Bausman, supervisor of meters of the Dayton Power & Light Company, following radio investigations over a period of five months.

Defective heating pads; operation of washing machines at home in the night; certain types of small electric fans; loose fuses, breaking less than an ampere; trouble in sets themselves that was overlooked by the radio repairman, and a host of other things were found to be causing the howls, buzzes and squeaks in the radios of certain neighborhoods. Among the cases investigated the following causes were giving the trouble:

Four defective heating pads were interfering with reception in sixteen cases; twelve cases were caused by five vibrating type chargers; cases of general atmospheric conditions, such as static and earth currents, mistaken for other interference, 15; regenerative sets, 11; commutator type motors, 6; railway signal apparatus, 2; street railway system bonds, feeders paralleled by aërials, etc., 21; "B" battery eliminators, wired wrong, or defective tubes, 4; defects in sets, 26; telephone ringing apparatus, 13; gas producer system, 1; defective wiring, defective switches, loose connections and loose fuses, 6; oil-burning furnace control, 2; company's equipment, 26, out of which one was due to a loose connection in a transformer fuse, 23 to street-lighting systems, and two to brush discharge on high-voltage insulators.

Issuing "Baby Bonds" on Consumers' Deposits

BY C. J. ALLEN
Executive Assistant Connecticut Light & Power Company, Waterbury, Conn.

TO MOST light and power companies, consumers' deposits are an office bugaboo. When we recently took over the Meriden Electric Light Company, we found that these deposits had been handled for some time through what might be called the "baby bond" method, and this worked so well that we are now adopting it throughout all our territory.

The scheme is as follows: Instead of giving the customer the usual form of deposit receipt, a bond is given in the same denomination as the deposit, usually $5 or $10, although in some commercial and power installations it is larger. The bond has coupons attached, as shown in the illustration, one coupon per year. At the end of each year the customer or bondholder cuts the coupon and presents it at the office, where he is paid the face value of the coupon, representing 4 per cent interest on the deposit.

This plan saves considerable accounting expense and detail hitherto required in handling consumers' deposits, especially where interest has been allowed on deposits at the beginning of each year and where at the end of each year an elaborate list must be made and posted to customers' accounts and then reposted to the bills in order that the proper credit may be received. Under the

CERTIFICATE OF DEPOSIT No 1000
This Certifies that
The Meriden Electric Light Company
TEN DOLLARS
as a guarantee for the payment
of all bills for Electric Current consumed at
IN THE CITY OF MERIDEN, CONNECTICUT
Such Deposit less such amount as Consumer may owe to be refunded upon expiration
of contract now existing and in force between parties hereto and named hereon.
We promise to pay interest thereon at the rate of four per centum per annum
payable January 1st in each year upon presentation and surrender of the respective
coupons hereto annexed as they severally become due.
THE MERIDEN ELECTRIC LIGHT COMPANY
NOT TRANSFERABLE
I HAVE WRITTEN HEREUNDER (ON THE DAY THIS CERTIFICATE WAS ISSUED TO ME) MY SIGNATURE, SUCH SIGNATURE TO BE USED BY GRANTOR AT THE TIME CERTIFICATE IS PRESENTED FOR REDEMPTION.
MERIDEN, CONN
RECEIVED AS REFUND IN FULL OF THE ABOVE AMOUNT
JANY. 1931
JANY. 1930
JANY. 1929
JANY. 1928
JANY. 1927
JANY. 1926
JANY. 1925
JANY. 1924
JANY. 1923
FORTY CENTS
No 1000

"BABY BOND" DEPOSIT COUPONS APPEAL TO CUSTOMERS

"baby bond" method all this detail is eliminated, and although the consumers' deposit records must be kept and the interest properly accumulated on the general books, the very considerable detail of listing and double posting is done away with. The cash is paid over the counter when the customer presents the coupon and record is made the next day.

Getting Commercial Results

ROCKFORD, ILL., is a Middle West city of about 90,000 population, which has the distinction of having some of the best electrical merchandisers in the country. The Rockford Electric Company, of which D. L. Cash is commercial manager, does not sell small appliances, lighting units or wiring except as a co-operative activity through the contractor-dealer. Mr. Cash says that the average contractor-dealer may not meet every accepted standard as a merchandiser, nevertheless his existence is vital to the industry.

What the contractor-dealer lacks in selling and technical knowledge can be furnished to him by the utility company through an organized trade-educational program. This policy has returned the company the co-operation and good will of the retailers and has enabled it to form and incorporate a contractor-dealer-workman-jobber trade association taking in every man in the trade who operates a store, sells appliances or carries pliers.

Through this association Mr. Cash expects to put over enough co-operative sales effort in the next three or four years on signs, stores and factory lighting, convenience outlets,

Essentials for Success in Electrical Merchandising

TEN SALES BUILDERS

1. **High-Type Human Material**—who can sell service, rates, companies and industry.
2. **Salespeople by Inclination and Desire**—not by force or promotion.
3. **Training**—in business, policies and practices; outside courses at individual's expense.
4. **Base Salaries**—sufficient to cover essential living expenses.
5. **Attractive Commissions.**
6. **Fit Individual to Work He Likes.**
7. **Departmentize on Budget and Quota Basis.**
8. **Planned Publicity**—to contractors, architects, sign prospects, factory executives, etc.
9. **Vision and Leadership.**
10. **Executive Recognition and Support.**

FACTORS THAT HELP SALES

Daily Conferences—on problems and experiences.

A "We" Organization—make men equally responsible with department head.

New Business Records and Reports.
Territorial Restrictions.
Specialists.
High-price, not high-cost men.

SOME AIDS A COMMERCIAL MANAGER SHOULD GIVE HIS SALESMEN

Employed by D. L. Cash, commercial manager, Rockford (Ill.) Electric Company

Preliminary company training.
Sales manuals.
Demonstrations.
Technical information.

PERSONAL

Fit the man to the job.
Daily conferences.
Quotas.
Prize contests.
Personal help in the field.

BASIC

Remuneration plan.
Analysis of buyers' resistance.
Analysis of salesman's weakness.
Establishing the point of contact.
Common laws of progress.
The logic of business.

INSPIRATIONAL

Develop will power.
Develop "staying qualities."
Keeping up enthusiasm.
Keeping up department morale.
Furnishing fresh viewpoints.
Promoting steady effort.
Philosophy of life.

ETHICAL

Relations of { Company and salesman. / Salesman and customer. / Customer and company.
Encouraging higher ideals.
Promoting personal thrift.
Promoting clean living.

GENERAL

Newspaper advertising.
Direct mail.
Education of users and public.
Neighborhood demonstrations.
Trial installations.
Public exhibits and schools.
Retailer organization.
Retailer training.

larger wattage lamps and appliance merchandising aids to bring the utility in increased revenue five times the amount of profit it could expect if it sold every small appliance that will be sold in Rockford in the next ten years.

Mr. Cash's outline of the essentials of a sales organization and factors which help sales is shown herewith.

Examples of the commission schedules in Rockford follow: (1) Ranges, 10 per cent of the retail price, averaging $15 per sale; (2) refrigeration, 10 per cent of retail, averaging $25 per sale; (3) water heaters, 10 per cent of retail, averaging $15 per sale; (4) factory lighting, $2 per kilowatt for net increases; (5) store lighting, $3 per kilowatt for net increases; (6) old unwired house services, $2.50 each; (7) electric signs, $2 per kilowatt of net increase plus 10 per cent of selling price paid by the manufacturer.

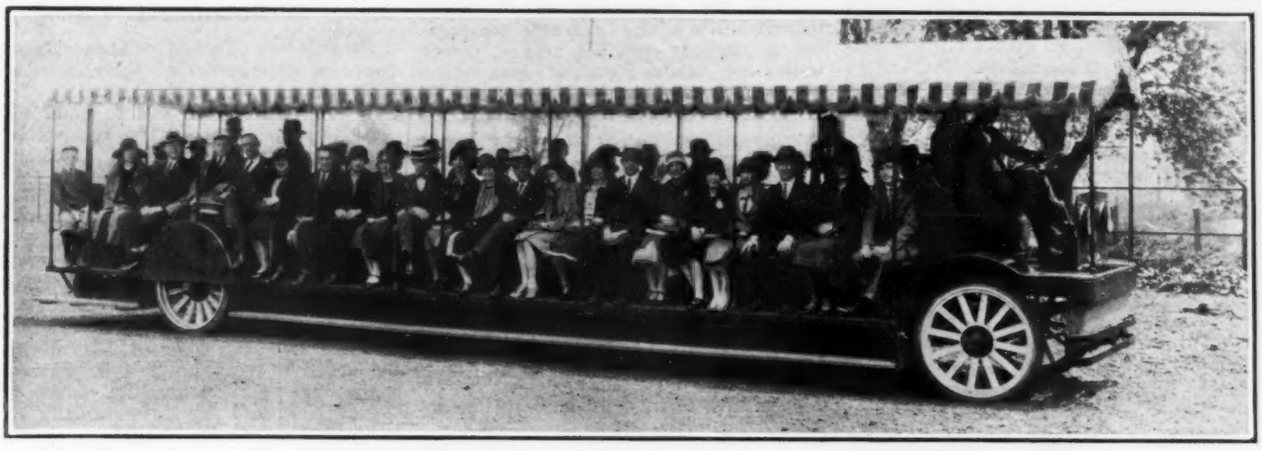
Electric Buses for Sesqui-Centennial

AMONG the many unique features which visitors to the Sesqui-Centennial Exposition will see and enjoy is the method provided for transporting the crowds of sightseers about the 750 acres of the exposition grounds.

A fleet of 25 electric buses of a design that will provide maximum comfort, convenience and safety for the passengers will be operated within the exposition inclosure, passing the principal buildings and points of interest. The buses will be operated by the Philadelphia Rapid Transit Company. The chassis are being built by the Commercial Truck Company of Philadelphia, which for more than twenty years has manufactured electric motor trucks and buses, and the bodies are being built by the J. G. Brill Company, also of Philadelphia.

The buses will have an over-all length of 33 ft. 6 in., with a wheelbase of 291 in. Each will be driven by two electric motors through a system of concentric gearing and will receive its power from a 40-cell, 29-plate Philco storage battery suspended under the frame of the bus amidships.

Arrangements have been made for charging the batteries on the exposition grounds, where a garage and charging station is being built to house the buses and charging apparatus. Each bus will follow a route approximately four miles long, returning to the charging station at the end of each route. Here the battery will be given a "boost" before the bus starts again over the course. It is estimated that the buses will cover something like twenty trips a day, or approximately 80 miles, a total mileage that is somewhat higher than is ordinarily the case for standard electric trucks or buses of like capacity.



ELECTRIC BUSES CARRY VISITORS THROUGH THE SIGHTS OF THE SESQUI-CENTENNIAL EXPOSITION

Puget Sound Company Sells 2,043 Ranges

THE Puget Sound Power & Light Company announces that in a 60-day campaign just completed in the Puget Sound district its sales department has established what is believed to be a new world's record for the sale of electric ranges. During this period 2,043 hotpoint ranges were sold, according to advices from H. J. Gille, general sales manager in Seattle.

Live Where You Serve, Says Executive

WITHOUT absolutely demanding it, the executive of one electric service company having headquarters in a city but serving neighboring territory advised all his headquarters staff in rather compelling language that few could resist to live in territory served by the company—not in the city. The purpose was not, of course, to add a few more kilowatt-hours to consumption, but to have the employees mix with and know the people served.

By close contact with customers, either in their home towns or riding to and from the city, the employees gain a better appreciation of the conditions they must meet and are frequently able to serve both the customers and the company by acting upon information picked up in casual conversation. In this way employees hear of dissatisfaction that may arise and can often prevent its spreading and growing. As a result, if some one is annoyed by poor voltage regulation or some other defect, it is common for a friend to say to him: "Oh, tell Smith, the fellow who lives in that brightly lighted house, about it; he will have it corrected"; or, "There is the fellow you want to tell it to, sitting on the other side of the car with Jim."

Aside from this human-relations aspect, when company men live in the territory their company serves it helps to build business by example, since all of these utility representatives practice what they preach—"Do it electrically." The equipment of their homes is a continuous demonstration of household appliances to their neighbors. And the story travels around.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Langerbrugge Power Station.—There is no power station in Europe which is of more interest to those who advocate higher steam pressures and temperatures than that at this location. The Langerbrugge station, as it exists at the present time, is of thoroughly modern design. The stores and administrative offices are in a separate building alongside, the power-house building containing nothing but machinery and apparatus. A single-sided boiler house has been adopted, with all the advantages of accessibility, natural illumination and ventilation which such an arrangement provides. The high-pressure equipment of the station consists of three boilers and a turbo-generator, together with all the necessary auxiliary apparatus. The boilers are of the Babcock & Wilcox marine type and are fitted with that firm's compartment-type chain-grate stokers and air heaters. No economizers are provided, as the feed water is heated to 384 deg. F. by steam before entering the boilers. The drums, which are of 3-ft. 6-in. internal diameter, are not of the hollow-forged construction which has been adopted for high pressures in certain cases, but are built up of plates in the usual way. The shell is 1⅜ in. thick and is strengthened with a plate of equal thickness where it is entered by the tubes. All water tubes are 3 in. in diameter and 13 ft. long. The superheater tubes are 1¾ in. in diameter and are expanded into cylindrical headers. The water level in the drum is shown by a Burnett-Brearley indicator, which consists of a pointer actuated by the weight of a movable chamber. It is to be observed that there is nothing "freakish" about the boiler plant. It represents very closely Babcock & Wilcox standard practice, with only such modifications as are indicated by the specially high pressure and superheat required. The turbo-generator to work with the new plant at Langerbrugge was designed and constructed by Brown, Boveri & Company. The turbine is constructed to take steam at the stop valve at a gage pressure of 710 lb. per square inch and at a temperature of 828 deg. F. It exhausts at a gage pressure of about 285 lb. into the main steam range of the station. The rated output of the plant under these conditions is 2,000 kva. The high-pressure boilers and turbine have now been running for some months in regular commercial service, and the results obtained thus far have been extremely satisfactory.—*Engineer (England)*, June 4, 1926.

Generation, Control, Switching and Protection

Windmills for the Generation of Electricity.—Until recently no attempt has been made to investigate systematically the design of a plant for the generation of electricity by wind power. Some investigations on the subject have been conducted recently by the Institute of Agricultural Engineering, Oxford University, and the results are now available in the form of a bulletin. The work was carried out at an experimental station, now dismantled, situated in a 17-acre field, midway between Harpenden and Luton. Passing to a consideration of the electrical requirements of a windmill plant, the report specifies the features desirable in the storage-battery equipment. These batteries are intended to supply power at periods of no wind and to steady the supply, which otherwise would fluctuate with the rise and fall of the wind. Reviewing the results, the report claims that in places where connection to a main electric supply system is not obtainable the generation of electricity by windmills bears favorable comparison as regards cost per unit of power with any other form of generating plant of similar size.—*Engineer (England)*, June 4, 1926.

Alternating-Current Pressure Regulators.—Part II.—A continuation of a series starting in the April 16 issue. The present article covers the applications of induction regulators to interconnected systems. The characteristics of regulators are discussed with diagrams, and illustrations of various types of Oerlikon regulators are included.—*Engineer, England*, April 23, 1926.

Transmission, Substations and Distribution

Economies of Tying Stations Into One System.—B. JANSEN.—The author is of the opinion that European countries should follow the American example of tying power stations into large systems, which would result abroad in economies like those reached in this country. In particular a combination of steam and hydro-electric stations can be so arranged and operated as to yield considerable gains. Fundamental data of a general nature, accompanied by algebraic and graphic representations, are given to show under what conditions interconnection may be expected to be profitable. Assuming a given load curve and varying costs of coal, the author points out that the co-operation of a steam plant with a water-turbine-driven station may save from 20 to 50 per cent of coal in the former plant.—*Elektrische Betrieb*, April 10, 1926.

Outdoor Substations.—R. DIACON.—For the supply of a Swiss aluminum plant one step-up and one step-down outdoor station have been erected, each of 16,000 kva. capacity. The generator voltage of 9,200 is first raised to the transmission potential of 60 kv. and subsequently lowered to 5,340 volts at the electrochemical plant. The two stations are identical, and each contains two water-cooled transformers of 8,000 kva. The losses of the transformers, amounting to 118 kw. each, are dissipated in a small cylindrical vessel, through which water flows, surrounding a cooling coil. A motor-driven centrifugal pump forces the hot oil of the transformers through this cooling coil. Oil and water flow, as well as oil temperature, are remotely indicated on an instrument board in the attendance room. All oil switches are motor-operated and have heating units in their tanks. A grounding choke coil provides protection against overvoltages.—*Brown, Boveri Mitteilungen*, May, 1926.

Electricity Supply in Melbourne Suburban Districts.—This paper is a description of the new scheme of bulk supply by the State Electric Commission of Victoria to the Melbourne Electric Supply Company with reference to the distribution of electrical supply to the Melbourne metropolitan area.—*Electrical Engineer of Australia and New Zealand*, May, 1926.

Units, Measurements and Instruments

Retardation Method of Loss Determination as Applied to Niagara Falls Generators.—J. ALLEN JOHNSON.—The purpose of this article is to point out certain advantages of the retardation method and to describe the procedure followed in testing the Niagara Falls generators. The basis of the method is first given, with the fundamental formula upon which it depends. Since it requires the use of a moment of inertia or "flywheel effect," methods of determining this value are given, and it is pointed out that it can be determined by tests. The methods of determining the speed of rotation and its rate of change are given, with a description of the devices used for automatically recording the necessary data and the method of interpreting such data. It is shown how the determination of losses over a range of speed increases the accuracy of the determination. General methods of testing are described, with a connection diagram and an outline of the necessary precautions. Detailed procedure for test for different losses is given. This method of tests furnishes data for the separation of the friction from the windage. The division of mechanical losses between generator and turbine in a specific case is also described. The procedure in determining the electrical losses from the test data is given, and some observations are made regarding the apparent desirability of the further refinement of the method used.—*Journal of A.I.E.E.*, June, 1926.

Illumination

Neon Lamp Stroboscope.—A. BERTRAND.—If a glow discharge neon lamp is energized by an adjustable-frequency alternating current, the light of this lamp may be utilized for a wide variety of electrical measurements, such as frequency and motor-slip measurements, determination of phase displacement, study of synchronizing problems, calibration of oscillatory circuits, etc. The adjustable frequency of the required alternating current is derived in a very simple way from a vibrating string, which is maintained in uniform vibration either with the aid of an auxiliary self-interrupting electromag-

net or acoustically by a microphone and series magnet. A special triple Z-shaped neon lamp of considerable luminosity has been developed for this new instrument to make observation possible in full daylight.—*Revue Générale de l'Electricité*, May, 22, 1926, and *Bulletin de la Soçiété Française des Electriciens*, April, 1926.

Motors and Control

New System of Control for Electrically Driven Winches.—J. BENTLEY.—In the first part of the paper the author reviews the conditions an electric winch or crane should fulfill and discusses the different ways in which these can be met and the difficulties and disadvantages entailed. An arrangement of contactors, resistances, etc., together with a patent speed-load device, is described as applied to an electric winch and its method of working, and performance under various conditions of hoisting and lowering loads is detailed. A simpler, more compact and less costly system obtained as a result of experiment is developed, with terms giving the various speeds obtained at different loads and a description of the safety devices incorporated. The requirements of service which must be fulfilled by an electrically driven winch are enumerated as follows: It must be possible to lift the load at suitable speed and to hold it from running back. The load must never be lowered at a speed beyond that at which the centrifugal forces set up in the armature reach a safe limit. All slack in the cable must be taken up without undue strain upon the gears when the slings tighten on the load. Above all, it must be possible to obtain good acceleration and retardation, thus enabling the cycle of operation to be completed as speedily as possible.—*Journal of Institution of Electrical Engineers (England)* May, 1926.

Heat Applications and Material Handling

Construction of Heating and Cooking Utensils—H. BOHLE.—This paper deals with temperature tests and life tests on heating wires for electrical heating and cooking utensils and with tests on hot plates and describes new types of elements and utensils. It is interesting to note that, in common with the results of other similar experiments, it was found that painting the bottoms of utensils black increased their thermal efficiency.—*Journal of Institution of Electrical Engineers (England)*, May, 1926.

Standard "Unit-Box" Grid Resistors.—H. H. WATSON.—One of the recent improvements in magnetic control for steel-mill auxiliaries and cranes is the "unit-box" construction of grid resistors. This construction facilitates quick repair, which insures better continuity of operation. It reduces the number of repair parts to a minimum, thus decreasing cost and storage space requirements. A complete resistor may consist of any number of the unit boxes. These boxes have been developed in nine standard ratings, which differ in resistance and current-carrying capacity. All of them are identical in overall dimensions, terminal location and supporting feet, so that they may be used in any combination necessary to give the desired resistance and current capacity. With the available values of resistance per division of the unit boxes, it has been found that any resistor layout can be obtained without exceeding allowable variations from calculated values. This means that the total number of different kinds of replacement parts for any number of installations of unit boxes will never be more than nine. This feature, which so materially assists in maintaining the continuity of service, is of very great value in steel-mill installation.—*General Electric Review*, June, 1926.

Traction

Yard Switching and Mill Transportation.—W. B. POTTER and G. H. SHAPTER.—That service is available for more hours, fewer locomotives are needed, maintenance cost is lower, fuel also costs less and smoke is eliminated are some of the reasons offered to justify a consideration of the electrification of transportation systems in mills. Consideration is given in turn to steam, "gas-mechanicals," "oil-electrics" and storage batteries with engine auxiliary units. As an example of the savings which may be expected by the use of electric locomotives, mention is made of a 5-ton storage-battery locomotive which was placed in service by the Youngstown Sheet & Tube Company. A "dinkey" locomotive used for this particular service gave trouble because of not operating smoothly. The battery locomotive proved entirely successful and incidentally reduced the cost of haulage by 46 per cent.—*Iron and Steel Engineer*, June, 1926.

Single-Phase, 50-Cycle Electric Locomotive.—The author describes a 50-cycle locomotive equipped with a novel type of compensating single-phase motor without a commutator, which it is claimed possesses the running qualities of the three-phase motor. The first vehicle to be equipped with the new motor was a small locomotive designed by Krupp for the removal of soil in excavation work, and the following are the leading particulars:

Weight in working order	46 tons
Adhesive weight	46 tons
Number of driving axles	4
Number of motors	2
Speed	6.85 m.p.h.
Continuous tractive effort	9 tons
Total continuous output of motors	450 hp.
Voltage (capable of being changed to 3,000-3,600)	1,500-1,800
Number of cycles	50
Speed of motors at a train speed of 6.85 miles per hour	750 r.p.m.

—*Engineer (England)*, June 11, 1926.

Telegraphy, Telephony, Radio and Signals

Development and Application of Loading for Telephone Circuits.—THOMAS SHAW and WILLIAM FONDILLER.—This is a review of the art of loading telephone circuits as practiced in the United States. The introductory section briefly reviews the theory of coil loading and summarizes the principal characteristics of the first commercial standard loading coils and loading systems, thereby serving as a background for the description of the various improvements of outstanding importance which have been made in the loading coils and loading systems during the past fifteen years to meet the new or changing requirements in the rapidly advancing art of communication. These major improvements are described in detail under these appropriate headings: (1) Phantom group loading, (2) loading for repeated circuits, (3) incidental cables in open-wire lines, (4) cross-talk, (5) telegraphy over loaded telephone circuits, (6) loading for exchange area cables, and (7) submarine cables. The discussion of these various developments sets forth the relations between the loading features and the associated phases of telephone development, such as the cables, repeaters, telegraph working and carrier telephone and telegraph systems. The concluding part of the paper gives some general statistics regarding the extent of the commercial application of loading in the United States and a brief statement indicative of its large economic importance.—*Bulletin Reprint B-196, Bell Telephone Laboratories.*

Miscellaneous

Cleaning Blast-Furnace Gases by Electricity.—Several developments have taken place recently in the electrical precipitation method for cleaning blast-furnace gases, and it is found that when collecting and removing suspended particles which do not vaporize at high temperature the precipitator can handle the gases as hot as they come from the source. The only limiting factor is the temperature which can be withstood by the material of which the precipitator is built, whether it is brick, steel or alloy. There are two types of electrical precipitation apparatus — that employing alternating current and that using direct current to maintain the electric field. When alternating current is used, precipitation can be effected, provided the gases are passing with no appreciable velocity; otherwise the effect is to agglomerate the particles into larger masses. The direct-current method is the more popular, because precipitation is possible when the gases are passing at an ordinary velocity, and the degree to which perfect cleansing is approached depends entirely upon the electric potential and the velocity of the gas. In the simplest form of apparatus the electrodes consist of a tube with a central or axial chain or wire. The tube, which is the channel for passing the gases, constitutes the grounded electrodes, and the chain, which is electrically insulated from the remainder of the apparatus, is negatively charged with a potential varying from 35,000 volts to 50,000 volts, which is usually derived by transforming a low-voltage alternating current to high voltage and then rectifying it to direct current. In the intense field thus created and maintained there is a silent discharge from the axial chain to the tube. The gas passing through becomes ionized, and the suspended particles are ultimately precipitated on the inner surface of the tube.—*Engineer (England)*, June 4, 1926.

News of the Industry

Proposed St. Lawrence Power Agreement

State Engineer Finch of New York Submits Outline of Conditions for Imposition in Contemplated Fifty-Year Lease to Private Company

STRESSING the necessity of the adoption of some practical method of developing St. Lawrence River power, preserving for the people their inalienable rights of ownership and control, but not depriving capital of initiative and a fair return on an investment, the report of State Engineer Roy G. Finch, rendered to the New York State Water Power Commission this week, declares that under the lease which he advocates the state can at any time take over the entire development and perhaps at a figure less than had the state itself financed and constructed the project. The engineer also declares that this provision, coupled with that relating to the immediate execution and filing of a quitclaim deed transferring to the people without cost all properties at the expiration of the license period, should eliminate any fear that the development of this power under a lease is a gift to any concern or corporation. "The people of New York are losing practically ten million tons of coal every year by not developing the water power of the St. Lawrence River," the report says.

As to the probable industrial expansion which would follow, State Engineer Finch says that "statistics show that in New England every dollar expended in the building of hydro-electric power plants has been matched by the expenditure of eight dollars for industries. If New York State in the development of the St. Lawrence River experienced the same stimulation to industrial growth as New England from its water power, we could look forward to the investment of almost a billion dollars in industrial enterprises." Mr. Finch advocates a single-stage in preference to a double-stage development.

YEARLY REVENUE $1,000,000

The report was prepared at the request of the New York State Water Power Commission, to assist it in disposing of the applications before it for development of St. Lawrence River power. Estimating $2.50 per year per horsepower as the reasonable license fee to be paid to the federal and state treasuries by the company developing the power, Mr. Finch contends that this would mean more than $1,000,000 a year in revenue to New York State at the outset and would be increased from year to year as a market is found for all the power that can be produced. The development would be approximately 2,500,000 hp., one-half of which would belong to Canada and the other half on the American side of the boundary.

The plans for development before the commission contemplate an investment of approximately $225,000,000. Any proposal accepted will be under a license determining that the investment within the boundaries of New York State will become the property of the people of the state at the end of 50 years. The state will thereby profit at the rate of 2 per cent each year on this investment, which would be equivalent to adding another $2,250,000 annually to the state treasury.

RECOMMENDED SAFEGUARDS

The principal provisions recommended for insertion in the lease are as follows:

1. The license period not to exceed 50 years and a definite term of not more than three years within which the licensee to proceed must obtain consents from other governmental agencies.
2. The license fee to be payable on completion of project, but not later than five years from the date when full authority to begin construction is granted.
3. Inspection by the state during construction, expenses of such inspection to be paid by the licensee.
4. The licensee to post a performance bond of $10,000,000.
5. On final completion of the project the state reserves the right to purchase at cost plus 15 per cent, or at any time during the license period on five years' notice at cost (less amount set aside for amortization) plus 15 per cent.
6. Guarantee that transmission lines will be provided by the licensee to insure distribution of St. Lawrence energy in every section of the state.
7. Full authority by the Public Service Commission to fix rates at which energy shall be sold, municipalities to receive preference.
8. The license fee to be adjusted at the end of five years and thereafter at ten-year periods.
9. At the end of 50 years, if the state has not taken over the project, all property, dams, power houses, machinery, lands and riparian rights on this side of the international boundary revert to the people without cost or expense, a quitclaim deed to be immediately executed and filed to carry this into effect.

The license fee that would be paid into the state treasury for the privilege of making this development, the taxes to be paid to the state, county and locality on taxable property created by the development and the equity which the people gain each year in ownership would aggregate a return of substantially $5,000,000 a year, the State Engineer contends.

REPORT APPROVED IN PRINCIPLE

Meeting in executive session on Tuesday, the New York State Water Power Commission received and approved in principle the report and recommendations of the State Engineer. It was decided to confer through a committee with authorities of the Province of Ontario on the matters involved. It is hoped to arrange the meeting some time next week in Toronto.

Negotiations will also be had with the federal government and other agencies whose approval is necessary. The matter will also be taken up with the two applicants — the American Super-Power Corporation and the Frontier Corporation—whose applications are now pending. It will be several weeks before the commission will be in position to take definite action on these applications.

O. D. Young Thinks Both St. Lawrence Plans Sound

Owen D. Young, chairman of the board of the General Electric Company, one of the units in the Frontier Corporation, an applicant for license to develop power on the St. Lawrence, said in an interview given to the press that, although he is "unreservedly in favor of private operation," nevertheless he views the plan advocated by Governor Smith for development by a public corporation the stock of which is to be owned by the state as also sound.

"It is for the state to choose between these two methods," Mr. Young said. "Both are progressive; neither is revolutionary. My point is that the public interest is sufficiently protected under either so that the development should proceed. Whether private interests can afford to undertake such a vast enterprise on such burdensome terms, I cannot say without further study. Assuming that the dam is to be built by private interests, no greater or better safeguards for the public can be found than those recommended by Mr. Finch under the existing law."

Colonel Hugh L. Cooper indorsed State Engineer Finch's report with enthusiasm and declared the Frontier Corporation ready to proceed with the work on a moment's notice.

Two-Stage Versus One-Stage Plant on St. Lawrence

In recent meetings at Brockville and Morrisburg, in eastern Ontario, C. A. Maguire, a member of the Ontario Hydro-Electric Power Commission, expressing confidence in the plans of that

commission's engineers for the hydro-electric development of the St. Lawrence River on the two-stage system, appealed for public support of that plan in preference to the one-stage system which the New York Water Power Commission is understood to favor. Mr. Maguire expressed himself with great positiveness, bordering on belligerency, in favor of the two-stage development, saying that so far as he is concerned it will be that or nothing.

The arguments favoring the double-stage development, Mr. Maguire said, were that power would be obtained three years earlier than if the single-stage development scheme were carried out, that the project would be easier to finance, that it would increase the available horsepower from the development by 100,000, that the power could be developed in more easily assimilated blocks, and the more sentimental reason that the double-stage system would make unnecessary the flooding of 29,000 acres of the finest farm land in Ontario.

Congress to Adjourn Without Reaching Muscle Shoals?

Unless a reported agreement between the Senate and House leaders falls through, Congress will adjourn at 3 p.m. today, leaving much unfinished business. There seems as the ELECTRICAL WORLD goes to press little possibility that the Muscle Shoals leasing bill will come to a vote at this session. The radio regulation bills, the departmental reorganization plans and other matters in which engineers and the electrical industry have more or less interest are also virtually certain to fail of passage.

Farm Engineers of Nation Gather in California

That any breaking down of electric system loads into their component parts such as is threatened by numerous municipalities can result only in undoing the progress already made by electric utilities and postpone the day when universal rural electrification will become an accomplished fact was a statement made by L. S. Wing, engineer California Farm Bureau Federation, before the twentieth annual convention of the American Society of Agricultural Engineers at Lake Tahoe, Cal., on June 23-26. In discussing rural electrification from an economic and engineering standpoint, Mr. Wing told the 170 agricultural experts present, who represented 31 states, that only with the economies effected by a highly diversified local load, coupled with the further economies which result from interconnection and consolidation, is general rural electrification possible.

The subject of rural electrification played an important part in the program of the convention. Experts discussed the application of electricity to the poultry industry, to the dairy industry and in orchard spraying. Prof. E. A. Stewart of the University of Minnesota, director of the Red Wing project; F. J. Zink and Arthur Huntington of Iowa and Harry L. Garver of Washington State were among those making valuable contributions to the discussions. Mr. Garver said that a study of a number of the orchards served by the Puget Sound Power & Light Company showed that 97 motors, aggregating 450 hp., utilized 60,000 kw.-hr. during one season and sprayed the orchards at a cost of approximately $2 per acre. More than 1,000 such outfits are in use in that section of the state and over 200 were sold during the present season.

Under the direction of E. A. White, director National Committee on the Relation of Electricity to Agriculture, several meetings were held with directors of the various state committees for the purpose of co-ordinating the work in the different states.

Municipal Power Project on Wynooche Carried

The proposed two-million-dollar bond issue by Aberdeen, Wash., to build a municipal dam and hydro-electric plant on the Wynooche River was carried on June 29 by a vote unofficially put at 2,435 to 1,600. This election followed a bitter campaign. The Gray's Harbor Railway & Light Company of Aberdeen also desires to develop this stream, concerning which a number of items have been printed in the ELECTRICAL WORLD. A previous favorable vote by the municipality was thrown out by the courts because it connected two projects —the hydro plant and a water-supply scheme.

Michigan Concentrates on Business

Rural Electrification, Summer-Resort Service, Radio Interference and Development of Refrigerator and Home Lighting Among Chief Convention Topics

MEETING on Mackinac Island on June 24, 25 and 26, the annual convention of the Michigan Electric Light Association and the Michigan Gas Association brought together four hundred men and women. Business sessions were held only in the mornings, the remainder of each day being available for recreation and those informal exchanges of experience which many consider the most valuable part of conventions. Operating managers of some of the smaller Michigan properties as well as division managers and department heads of the large companies were well represented. The electric association held two independent sessions, and there was one joint session of the two bodies, the keynote of which was the desirability of co-operation between the gas and electric industries, particularly in research work.

At Thursday's session President F. D. Avis emphasized the difficulties of operation and service on small properties with limited power facilities when there is an opportunity to take on large power loads, pointing out that isolated properties cannot take the same risk that might be assumed by interconnected plants. No one who has not attempted the stimulation of range load can realize its opportunities, he declared. Unfortunately, the affiliation of gas with electric properties is evidently making some companies neglect the opportunity.

Eugene Holcomb, Consumers Power Company, gave an excellent résumé of the rural electrification situation and the prospects. He warned against the promiscuous building of rural lines and urged their confinement to groups of farmers who will agree to use sufficient energy to pay the cost of service and can profit by so doing. Because of the lack of interest on the Parma experimental line a new one is being constructed between Dansville and Mason. To indicate the amount of money required for rural electrification he presented figures on electrifying a single township. Saddling any of the burden on urban customers was discouraged.

A paper on the sale of domestic refrigerators by R. L. Parker discussed in considerable detail the methods of the United Appliance Company. In the ensuing discussion it was contended that the idea of better refrigeration should be sold first and the specific apparatus last of all.

A symposium, contributed to by R. Evans, S. P. Selden, J. D. Farmer, A. E. Wright and R. T. Duncan, brought out the practices used in handling summer-resort service and the rates for it in different parts of Michigan. The difficulty, much as with rural service, but even worse, is the short-season use of a small amount of energy and the necessity of stimulating consumption. Quite generally a fairly high fixed charge is made and supplemented by step rates similar to those in cities. Greater use of domestic appliances would help this business, it was asserted.

At the joint session on Friday, Alfred Fischer, director of the Michigan Committee on Public Utility Information, reported on the past year's progress; Misses Margaret Hayes and Stella Hubbard presented an entertaining sketch on "Satisfying the Customer"; Alexander Forward told of activities under way by the gas industry, and Floyd Parsons presented in popular fashion some results of scientific research.

Women representatives of utility companies were in prominence at the convention, a luncheon being held to discuss their activities and a report being presented at Saturday's meeting by Mrs. Thelma Van Ness, state chairman of the women's committee. How the Detroit Edison Company is promoting better home lighting was explained by Mrs. M. Dygert in considerable detail.

H. H. Field, secretary of the Great Lakes power survey committee, touched on the method of preparing the survey and discussed the features of the report.

Inasmuch as 25 per cent of electric customers are radio enthusiasts, light and power companies cannot afford to ignore radio interference complaints and should find out to what extent their equipment is interfering and then correct the trouble, declared D. A. Gerhardt. Furthermore, unsatisfactory radio reception means less domestic

lighting consumption, possibly as much as 30 per cent. The speaker described a co-operative educational plan as part of which a systematic patrol is now maintained to detect and correct interference with reception.

D. E. Byerley, Citizens' Light & Power Company, Adrian, was elected president for the coming year, and Howard Pett, Consumers Power Company, Jackson, vice-president. Herbert Silvester, Ann Arbor, continues as secretary-treasurer.

Six More Institute Papers

Last Day's Technical Sessions of A.I.E.E. Convention Maintain Its High Mark

FRIDAY'S proceedings at last week's convention of the American Institute of Electrical Engineers at White Sulphur Springs, West Va., the first four days of which were reported in the ELECTRICAL WORLD for June 26 (page 1387), comprised two parallel technical sessions covering a wide range of interest.

Of the three papers offered at session "A," the one presented by P. L. Hoover on the mechanism of breakdown of dielectrics inspired the most discussion. This, of course, is because the facts of dielectric failure are not yet definitely established and all contributions to this subject have, like the paper presented, been speculative in greater or less degree. Mr. Hoover's contribution was an admirable collation of the work of other investigators developed into a single thesis with the reports of his own experiments and the conclusions drawn from them. The conclusion arrived at was that the mechanism of dielectric failure is not a simple phenomenon but is the combination of three effects, the first thermal and the other two high-frequency effects due to non-uniform field and to composite or heterogeneous dielectric material, all three of these, in varying degree, operating to upset the kinetic equilibrium between the ions and molecules of the dielectric.

W. A. Del Mar, chairman of the session, pointed out that certain evidence used by Mr. Hoover to develop his ideas was perhaps not applicable on account of the fact that some of the investigations of Wagner and others cited were concerned with direct current and others with alternating current and that for this reason their conclusions perhaps could not be paralleled. The discussion of the paper covered a wide field of conditions of cable construction and performance, ranging from direct references to specific failures to remarks on characteristics of dielectrics.

The developments in the design of mercury-arc rectifiers as recounted by D. C. Prince were of much interest, particularly to representatives of operating companies present. Mr. Prince's paper exposed the operation of a rectifier in detail. In spite of the fact that the mercury-arc rectifier has been known for about 24 years, it is only in the past few years that its principles of operation have begun to be understood, and even yet there are some points not conclusively proved. The paper explained the probable mechanism of the electron source, indicated the sources of various losses, described the probable operation of arc-back, explained the principles of rectifier circuits and illustrated a variety of rectifiers of different kinds and sizes. In discussion of this paper, A. Odermatt stated that in Europe one manufacturer had sold 800 rectifiers with a total capacity of over 300,000 kw. and that the failures of this type of apparatus were lower in percentage than with rotating machinery. W. A. Hildebrand brought up the point of possible radio interference, and the author of the paper said that there was no inherent characteristic of the rectifier to make it any more a source of radio interference than is any other kind of apparatus.

A vibration recorder for electrically measuring movements was described in a paper by A. V. Mershon. This instrument makes it possible to obtain oscillographic measurement and records of rapid mechanical movements as small as five-thousandths of an inch. It has been used to obtain data on vibrations of a rotating turbine wheel, whipping of a rotating shaft and transient oil pressures produced by the opening of a high-voltage switch.

In the parallel session "B" three excellent papers were presented. S. L. Gokhale gave an experimental and theoretical discussion of magnetism in which he found a logarithmic law more accurate over a wide range of magnetization than the Kennelly and Frolich equations. G. E. Luke discussed experimental results of heat transfer in electrical machines with forced air flow. W. L. Upson developed the general theory and vector diagrams for auto-transformers. J. R. Craighead and E. J. Burnham discussed the papers.

Purchases and Mergers

Fitkin and Foshay Properties Figure Prominently in Light Record of New Transactions

APPLICATION for permission to form the Michigan United Light & Power Company as a consolidation of the present Michigan United Light & Power Company, the White River Power Company, Boyne City Electric Company, Boyne City River Power Company, Michigan Public Service Company, Elk Electric Company and Grayling Electric Company, all operating in the northern part of the lower peninsula of Michigan, has been filed with the Public Utilities Commission of that state. These are all A. E. Fitkin properties.

The W. B. Foshay Company has contracted to purchase the West Coast Power Company now owned and operated by Cammack & Company of Chicago. The West Coast Power Company will be known as the People's West Coast Hydro-Electric Corporation. It serves Reedsport, Gardiner, West Gardiner, Florence, Glenada, Cushman, Waldport, Toledo, Newport, Yaquina, Clatskanie, Clatskanie Junction, Westport, Quincy, Cascade Locks and Burns, in Oregon, and Shelton, Cathlamet, Stevenson, Chinook, Long

RETIRING AND INCOMING INSTITUTE PRESIDENTS (SECOND ROW FRONT) SURROUNDED BY DELEGATES AND VISITORS

Beach, Seaview, Ocean Park, Nahcotta, Breakers, Newton, Tioga, Centerville, Shelbourne and Holman, in Washington. The properties of the Ilwaco (Wash.) Light & Power Company of Ilwaco and the Willapa Power Company of South Bend, Wash., which were previously purchased by the Foshay company, will be taken over by the People's West Coast Hydro-Electric Corporation. This company will itself be operated in conjunction with the People's Light & Power Corporation, of which the formation has been already noted and which will now have constituent properties in Wisconsin, Minnesota, Iowa, Washington, Oregon, Arizona and Vermont. The acquisition of plants in the state last named was chronicled on June 19 (page 1361).

Gordon, Neb., has, by a vote of 200 to 185, carried a proposal to sell its municipal electric plant to the Nebraska Electric Power Company, which has headquarters at Loup City. The company is to pay $10,000 down and to liquidate $63,000 in city bonds when they become due.

The Central Wisconsin Power Company has absorbed the transmission and distribution systems of the Caroline Electric Company, to which it has been wholesaling energy for redistribution. The territory served includes a large rural area.

The Adirondack Power & Light Corporation has asked the New York Public Service Commission for permission to acquire the Port Henry Light, Heat & Power Company, which operates in adjacent territory.

Petition has been made to the New York Public Service Commission by the Campbell Transmission Company of Hounsfield, near Watertown, for authority to transfer its plant to the Northern New York Utilities, Inc. The Campbell company operates electric lines between Sackett Harbor and Campbell's Point and between Adams Basin and Smithville.

The New York Public Service Commission has granted the petition of the Eastern New York Utilities Corporation to acquire the stock of the Blue Hill Light & Power Company, reported May 29 (page 1210).

Southern California Edison Again Sues Los Angeles

Claiming violation of the power contract given by the city as part payment for the purchase of the company's distributing system in Los Angeles, the Southern California Edison Company has sued for an injunction against the city of Los Angeles and its Board of Water and Power Commissioners to stop the operation by the Bureau of Power and Light of three Diesel-engine electric generating plants, two in the San Fernando Valley and one in another location. The complaint recites the terms and conditions of the power contract executed by the city under which for a period of ten years from May 16, 1922, the city agreed to buy from the company all of electrical energy required over and above the amount produced at the city's own hydro-electric plants. The company puts the capacity of the plants it is endeavoring to shut down at not less than 5,000 kw. and their probable cost of operation at something more than $20,000 a month.

As previously reported, the Southern California Edison Company applied last February for an injunction to prevent Los Angeles from building a steam standby plant. This suit is not yet settled, but the city has placed orders for equipment rated at 33,000 hp.

The Southern California Edison Company has, besides, filed suit in the Superior Court against the city of Los Angeles and the Board of Water and Power Commissioners for $840,155, which the company claims is due as balance of a bill for $3,668,353 for electrical energy purchased by the board from January, 1925, to May, 1926, inclusive, and for the month of July, 1924. The complaint alleges that the city has paid $2,818,198 but has rejected the company's bills for the balance declared to be due. The company's petition asserts that the electricity was delivered to the city under contract.

New N.E.L.A. Appointments Made Early

Heads of National Sections Will Be: Accounting, W. B. S. Winans; Commercial, J. E. Davidson; Engineering, C. F. Hirshfeld; Public Relations, W. A. Jones

PRESIDENT R. F. PACK of the National Electric Light Association, in his desire to continue without interruption the operations and progress of the association, has appointed most of the special and general national committees, as well as the officers and members-at-large of the Accounting, Commercial, Engineering and Public Relations National Sections. The appointments made up to time of going to press, which became effective on July 1, follow:

ACCOUNTING NATIONAL SECTION

Chairman—W. B. S. Winans, Henry L. Doherty & Company, New York.

Vice-chairmen—Robert B. Grove, United Electric Light & Power Company, New York, and W. R. Emerson, Oklahoma Gas & Electric Company, Oklahoma City, Okla.

Members-at-Large—(terms expiring June 30, 1927): C. M. Breitinger, E. W. Hodges, J. H. Lobban, B. F. Braheney; (terms expiring June 30, 1928): Franklyn Heydecke, Walter C. Lang, W. Paxton Little.

COMMERCIAL NATIONAL SECTION

Chairman—J. E. Davidson, Nebraska Power Company, Omaha.

ENGINEERING NATIONAL SECTION

Chairman—C. F. Hirshfeld, Detroit Edison Company, Detroit.

Vice-chairmen—Markham Cheever, Electric Bond & Share Company, New York; Nicholas Stahl, Narragansett Electric Light Company, Providence, and E. C. Stone, Duquesne Light Company, Pittsburgh.

Members-at-Large — (terms expiring June 30, 1927): H. P. Liversidge, W. H. Cole, W. G. Kelly, O. G. Thurlow; (terms expiring June 30, 1928): R. R. Cowles, Thomas Sproule, R. H. Tapscott.

PUBLIC RELATIONS NATIONAL SECTION

Chairman—W. A. Jones, Henry L. Doherty & Company, New York.

Vice-chairmen—H. C. Abell, Electric Bond & Share Company, New York; E. A. Barrows, Narragansett Electric Lighting Company, Providence, and J. F. Owens, Oklahoma Gas & Electric Company, Oklahoma City.

Members-at-Large—(terms expiring June 30, 1927): M. S. Sloan, T. A. Kenney, Marshall E. Sampsell, Guy W. Talbot; (terms expiring June 30, 1928): C. P. Billings, John F. Gilchrist, A. C. Marshall.

SPECIAL NATIONAL COMMITTEES

Advertising Committee—Chairman, W. H. Hodge, Byllesby Engineering & Management Corporation, Chicago.

Charles A. Coffin Prize Committee—Chairmen, R. F. Pack, Northern States Power Company, Minneapolis; R. H. Ballard, Dr. Samuel W. Stratton, William W. Trench.

Codes and Standards Committee—Chairman, Frank W. Smith, United Electric Light & Power Company, New York; G. H. Harries, A. C. Marshall, C. A. Pratt, Marshall E. Sampsell.

Constitution and Bylaws Committee—Chairman, W. C. L. Eglin, Philadelphia Electric Company, Philadelphia; R. F. Pack, P. S. Arkwright, John B. Miller, H. T. Sands, M. S. Sloan,

Electrical Resources of the Nation Committee—Chairman, C. E. Groesbeck, Electric Bond & Share Company, New York; R. F. Pack, P. S. Arkwright, R. H. Ballard, John B. Miller, W. A. Jones, W. H. Onken, Jr., H. T. Sands, M. S. Sloan.

Electrification of Steam Railroads Committee—Chairman, Britton I. Budd, Public Service Company of Northern Illinois, Chicago.

Finance Committee—Chairman, Sidney Z. Mitchell, Electric Bond & Share Company, New York; N. F. Brady, Charles L. Edgar, Samuel Insull, J. J. O'Brien, P. S. Young.

Lamp Committee — Chairman, Frank W. Smith, United Electric Light & Power Company, New York; Robert B. Grove, W. H. Atkins, Douglass Burnett, Walter Cary, S. E. Doane, S. Ferguson, W. W. Freeman, E. W. Lloyd, George F. Morrison, Charles J. Russell, J. T. Scott.

Prize Awards Committee—Chairman, W. H. Onken, Jr., ELECTRICAL WORLD, New York.

Rate Research Committee—Chairman, Edwin Gruhl, North American Company, New York; C. E. Neil, John W. Lieb, L. R. Nash, E. N. Strait, W. G. Vincent, Jr.

Water-Power Development Committee — Chairman, W. E. Creed, Pacific Gas & Electric Company, San Francisco; R. H. Ballard, H. T. Edgar, H. W. Fuller, D. C. Green, D. L. Huntington, A. W. Leonard, J. D. McKee, Paul A. Schoellkopf, Guy W. Talbot, A. B. West, E. A. Yates, A. G. Wishon.

GENERAL NATIONAL COMMITTEES

Educational Committee — Chairman, Fred R. Jenkins, Commonwealth Edison Company, Chicago.

Insurance Committee — Chairman, G. H. Bourne, Hodenpyl, Hardy & Co., Inc., New York.

Membership Committee—Chairman, Howard K. Mohr, Philadelphia Electric Company, Philadelphia.

Rural Electric Service Committee—Chairman, G. C. Neff, Wisconsin Power & Light Company, Madison.

RELATED ORGANIZATIONS

Chamber of Commerce of the United States—National Councilor, John W. Lieb, New York Edison Company, New York; alternate national councilor, R. E. Breed; delegates, R. F. Pack, S. Ferguson, Walter H. Johnson, J. R. Lovejoy, Thomas N. McCarter, L. A. Osborne, M. S. Sloan, Herbert A. Wagner.

Committee on the Relation of Electricity to Agriculture—Chairman, C. W. Drake, Westinghouse Electric & Manufacturing Company, East Pittsburgh; Arthur Huntington, J. C. Martin, G. C. Neff, K. A. Pauly.

Electrical Manufacturers' Council—Chairman, R. F. Pack; H. T. Sands, P. S. Arkwright, John B. Miller, M. S. Sloan, P. S. Young, M. H. Aylesworth.

International Chamber of Commerce—Chairman, John W. Lieb, New York Edison Company, New York; R. E. Breed, R. F. Pack, Samuel Ferguson, Walter H. Johnson, J. R. Lovejoy, Thomas N. McCarter, L. A. Osborne, M. S. Sloan, Herbert A. Wagner.

Joint Committee on Theft of Gas and Electrical Energy—Chairman, Hinton G. Clabaugh, Commonwealth Edison Company, Chicago; W. M. Halsey, E. E. Hill.

National Industrial Conference Board—Chairman, John W. Lieb, New York Edison Company, New York; Charles L. Edgar, R. F. Pack.

American Engineer Reports on Victoria's Power Plans

Willits H. Sawyer, president of the East St. Louis & Suburban Railway Company, who about five months ago was, with Herbert W. Eales, chief electrical engineer of the Union Electric Light & Power Company of St. Louis, commissioned by the government of the State of Victoria, Australia, to "inquire into the status and affairs of the Electricity Commission of Victoria and the scope and workings of the State Electricity Commission acts," has made a report to the Victorian authorities. The undertakings that have been under investigation include the one which supplies the city of Melbourne with power from a plant in the Yallourn "brown-coal" region and a hydro-electric scheme known as the Sugarloaf-Rubicon project.

Mr. Sawyer finds that the government's combined undertakings are economically sound and that, though not financially profitable at present, they should show a favorable balance by 1929-30. Concerning the burning of brown coal containing 65 per cent moisture, which is the kind found in a new cut opened by the government, Mr. Sawyer recommends further study and the postponement of the erection of any major power-plant extension. In the meantime he favors using fuel from an older open cut where the moisture content is approximately 48 per cent. The existing plant, Mr. Sawyer says, is adapted to burn this coal, but is not satisfactory when the moister coal is burned.

Mr. Sawyer holds that though the Sugarloaf project, which is primarily an irrigation undertaking, would not be practicable as a power producer by itself, it could be used to advantage in connection with the Yallourn plant for at least eight months of the year. The transmission line from Yallourn to Melbourne is well built, but requires additional insulation, the American engineer finds. He recommends the addition to the commission of engineers experienced in handling large power plants, who would probably have to be sought abroad.

Virginia Farmers' Interest in Electric Service Grows

Fewer than 500 farms in Virginia of ten acres or more and from which the owners derive the major part of their income have electric service from central plants, according to a survey conducted by the agricultural engineering department of the Virginia State Agricultural College, the results of which have just been published in a report on "The Present Status of Rural Electrification in Virginia," compiled by the Virginia Committee on the Relation of Electricity to Agriculture. This report tells of the experimental line constructed in the Fairfield district of Henrico County to aid an investigation into the use of electricity on truck, dairy, general, poultry and fruit farms. Some of the facts and conclusions arrived at follow:

While, as just stated, fewer than 500 farms use electricity from central power stations, about 10,000 farms in the state use individual gas-engine-driven plants and in the southwest and valley Virginia many plants are driven by waterwheels. The effect of the use of lights on egg production is the experiment of the most popular appeal. Dairying uses more electricity than any other type of farming. Farmers are somewhat ignorant concerning why there should be losses in the distribution of electricity. Farmers would like to turn the lines they now own over to the power companies. The farm peak load comes in September and is due largely to pumping water. The extent to which appliances are used is dependent upon the charge for electric service. Electric flatirons are the most popular appliance, water systems rank second, vacuum cleaners third and washing machines fourth. Appliances are much more numerous on farms having central-station service than on farms having service from individual plants. The highest rate per kilowatt-hour in the state is 20 cents and is on the Eastern Shore. There is no uniformity among the power companies as to rural rates or methods of financing rural lines.

The survey in the field was under the direction of James A. Waller, Virginia Polytechnic Institute. Charles E. Seitz of this institute heads the Committee on the Relation of Electricity to Agriculture.

Industry Joint Conference on Wiring

Electragist and N.E.L.A. Wiring Committee Invite Earl E. Whitehorne to Organize Fact-Finding Body—Manufacturers and Jobbers Vote to Participate

A JOINT conference of the four principal branches of the electrical industry is now being organized as a fact-finding body to make a thorough study of the trend of wiring. It will investigate the general subject of the cost of wiring and the influence of various wiring methods on the progress and adequacy of wiring installations, particularly in houses. Advocates of all-metal construction, knob and tube work and non-metallic sheath cable having long been in controversy over the effects of the different systems on the sale of housewiring, and therefore on the expansion of the market for electrical equipment and appliances of all kinds, the Association of Electragists and the wiring committtee of the National Electric Light Association have jointly invited Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, to take the initiative, as a neutral individual associated broadly with all branches of the electrical industry, in calling together representative delegations from the four associations of the electric power companies, contractor-dealers, manufacturers and jobbers to develop the needed facts on which the industry may base intelligent opinion.

Mr. Whitehorne agreed to undertake the work provided that the Electrical Manufacturers' Council and the Electrical Supply Jobbers' Association also desired to participate in such a conference and requested him to serve as its chairman and together with the N.E.L.A. and A.E.I. were willing to support such a market study financially and otherwise within the judgment of their respective delegates. The plan has now been laid before the governing bodies of the manufacturers and the jobbers, and both organizations have voted unanimously in favor of the program. The delegations which will represent the four associations in the conference are now in process of appointment but will not be announced until after the meeting of the N.E.L.A. executive committee late in August.

For the purpose of indicating the general lines along which this joint conference on the trend of wiring may be expected to direct its survey, unofficial and purely tentative suggestions have been considered by each of the organizations participating in the form of the following ten questions to which the conference might well seek to find the answers:

1. What is the present trend in the cost of wiring?
2. Is the present cost of wiring retarding the installation of electric lighting and appliances or restricting the adequacy of installations?
3. What is the present trend in the adequacy of wiring?
4. What influences are today encouraging or restricting the adequacy of wiring installations?
5. What is the influence on the progress of house wiring of different systems of electrical construction required by municipal regulations within a community, such as "rigid conduit only" and the "all-metal standard"? Are a larger percentage of houses being wired, or are wiring installations more adequate where knob and tube work is common or where non-metallic sheath cable has been extensively used?
6. Is excessive cost of wiring, if and where found today, chargeable to over-expensive material, or to an abnormal scale of wages for labor, or to restrictions on the output of labor?
7. Are present wiring methods wasteful, and does the cause appear to be superstandards of quality in wiring materials and equipment or lack of training and skill in workmanship?
8. If buildings, old and new, are not being wired in sufficient number or adequately wired, how often is the restraining influence the high cost of electrical energy?
9. Is the progress of house wiring being held back to any extent by over-restrictive policies on the part of the central station in regard to extensions, or capacity, or readiness to serve?
10. Is slow progress in the wiring of houses and the inadequacy of installations commonly chargeable to lack of co-operation between the contractors and the central stations, and who is most responsible?

Wisconsin Power & Light's Wolf River Plans

The water-power development program of the Wisconsin Power & Light Company on the Wolf River in Wisconsin, involving dam sites in the Menominee Indian reservation for which a preliminary permit is being sought from the Federal Power Commission, may mean the ultimate development of 25,000 hp. at a cost of several million dollars. Four other sites owned by the company, three in Langlade County and one in Shawano County, will be developed by it regardless of the commission's action. The first project will be near the city of Shawano and will cost $250,000, according to Vice-president G. C. Neff.

Under the plan proposed these hydro-electric plants are to be controlled by a master station, following the arrangement which is being successfully used by the Wisconsin Public Service Corporation for its hydro-electric plants on the Peshtigo River.

The Wolf River plants will be tied in with the 66,000-volt transmission lines of the company serving the central and southern parts of Wisconsin, and substantial benefits will result to the interconnected territory served by the Central Illinois Public Service Company. The survey made in the reservation indicates that more than 12,000 hp. can eventually be developed on the river.

Commercial Topics Discussed at Watertown, N. Y.

The Commercial Section of the Empire State Gas and Electric Association held its annual meeting at Watertown, N. Y., on June 24 and 25. The papers and discussions were devoted to actual commercial practices and proved of no small interest.

R. M. Martin described methods used by the Consolidated Gas Company to sell the value of its service through window displays, while A. W. Humm outlined some objectives and fundamentals of utility advertising.

The purposes, methods of organization and some of the experiences of the home service departments of their companies were recounted in papers by Miss Laura Rischman of the Buffalo General Electric Company and Mrs. Cecil Harvey of the Westchester Lighting Company.

The Friday morning session included papers by John L. Haley advocating special effort in developing rural business and by C. R. Vanneman, who told the causes of some complaints to the Public Service Commission, of which he is chief engineeer. Most of these complaints were due to misunderstanding or misinformation. G. I. Vincent showed slides of a home designed particularly for complete electric and gas service, including house heating.

M. S. Sloan, president of the Brooklyn Edison Company, made the last address, in which he voiced approval of conventions, but urged that they be so conducted that the delegates shall get every possible aid from them.

E. L. Wilder, Rochester Gas & Electric Corporation, was elected chairman of the Commercial Section to succeed R. V. Howes, and W. A. Morris was elected vice-chairman.

Boston Edison-Cambridge Power Contract

Particulars are now available of a contract recently negotiated between the Edison Electric Illuminating Company of Boston and the Cambridge Electric Light Company under which the growing demands for electrical service in the university city will be more advantageously handled. The contract calls for the provision of 26,000 kva. in line capacity, and until such time as the Edison company has received $1,500,000 from the Cambridge company this maximum is to be available at the Boston-Cambridge city line. For some time the Cambridge company has been buying a small portion of its energy from the Boston system on the so-called "D," or wholesale lighting, rate. In 1925 2,105,000 kw.-hr. was thus purchased at 3.45 cents per unit. The new contract falls under the "N," or co-operative wholesale, rate. It was made with the understanding that the Edison company would include in this schedule a step of 0.55 cent per kilowatt-hour for all energy in excess of 3,000,000 kw.-hr. per month. For the first 30,000 kw.-hr. the rate is 2 cents; for the next 70,000, 1 cent; for the next 900,000, 0.8 cent; for the next 2,000,000, 0.7 cent. The contract carries a coal clause with a base of $3.75. After the Cambridge company has purchased energy to the amount of $1,500,000 the contract continues in effect unless terminated on sixty days' notice.

Lighting Equipment Makers Change Society Name

A condition of overproduction in the electrical fixture and lighting equipment business in the United States and Canada was explained by J. W. Schulze, who as vice-president reported to the annual convention of the National Council of Lighting Fixture Manufacturers held in Montreal from June 23 to 25, as due to the subsidence of the post-war building boom. He urged the necessity of collective efforts by the fixture men to increase the demand, improve the service to the public and raise the standard of ethics.

The principle of a four-year co-operative advertising and merchandising program was indorsed by the convention. One of the main objectives will be the replacement of obsolete lighting equipment in American homes. G. P. Rogers, as managing director of the association, which will hereafter, be named the Artistic Lighting Equipment Association, will be in charge of activities, which will cover simplification and standardization of design and improved methods of individual operation.

The following officers were elected for the ensuing year: President, Fred R. Farmer, Chicago; vice-president, J. W. Schulze, Providence, R. I.; managing director, G. P. Rogers, with H. B. Garrett as his assistant, both of Cleveland.

Briefer News

Edgar Station of Boston Edison to Install 60,000-Kw. Unit.—Announcement has just been made by the Edison Electric Illuminating Company of Boston that a 60,000-kw., 400-lb.-pressure steam turbine unit will soon be added to the equipment in its Edgar (formerly Weymouth) station on Fore River. The contract is likely to be awarded in a week or two.

Nashville Railway & Light Company Adds Equipment.—The Nashville Railway & Light Company, which has just completed a new substation in the Tennessee capital, will on July 15 give a trial performance to a new 20,000-kw. turbo-generator installed at a cost of more than $600,000. This new machine, Vice-president J. P. W. Brown announces, has been made necessary by the great increase in building in the downtown section of the city.

Texas Panhandle's Projected Natural-Gas Generating Plant.—Progress is being made in promoting the construction of a great electric power plant in the natural-gas field of the Panhandle of Texas, according to C. Berg, a Detroit engineer, who recently laid the proposition before the business men of Amarillo, Tex. Mr. Berg says that a delegation of Detroit capitalists will visit the gas field and investigate its possibilities for generating electric power. The first unit of the proposed plant would cost approximately $1,000,-

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in this issue of the ELECTRICAL WORLD, page 50.]

East Central Division, N. E. L. A.—Cedar Point, Ohio, July 13-17. D. L. Gaskill, Greenville, Ohio.

Association of Electragists International—Hotel Breakers, Cedar Point, Ohio, Aug. 24-27. L. W. Davis, 15 West 37th St., New York.

Camp Co-operation VI (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 1-4. (Society for Electrical Development, New York, is sponsor.)

Illuminating Engineering Society—Essex and Sussex Hotel, Spring Lake, N. J., Sept. 7-10. L. H. Graves, 31 West 46th St., New York.

Wisconsin Utilities Association, Electric Section—Eau Claire, Wis., Sept. 3 and 4. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 20-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Sept. 30-Oct. 1. C. H. B. Chapin, Grand Central Terminal, New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 1 and 2. A. Bliss McCrum, secretary.

000, according to Mr. Berg, and power transmission lines would be constructed to towns within a radius of 200 miles.

Cherokee Bluffs to Become "Lake Martin."—By a resolution passed last week by the directors of the Alabama Power Company, the dam now under way on the Tallapoosa River at Cherokee Bluffs will be known as "Martin Dam" and the great artificial lake that is to be formed there will become "Lake Martin." These names have been adopted in honor of Thomas W. Martin, president of the Alabama Power Company, whose plant at this site is being pushed to completion.

Assets of Standard Gas & Electric Company $900,000,000.—H. M. Byllesby & Company have just published a 32-page illustrated book describing the Standard Gas & Electric Company and its operated and affiliated public utilities. Forty-five photographs of the principal steam and hydro-electric stations, substations, gas-manufacturing plants, etc., are reproduced. A large four-colored map showing the extent and diversification of the company's investments is included. The system of the Standard Gas & Electric Company is one of the largest groups of public utility companies in the United States controlled and operated by a single company. The combined annual gross earnings of the present operated and affiliated utility companies are more than $140,000,000, and the total assets exceed $900,000,000.

Lawrence (Mass.) Rate Made 9 Cents.—A maximum net rate of 9 cents per kilowatt-hour was fixed by the Massachusetts Department of Public Utilities in a finding issued last week, effective July 15, in answer to a petition of consumers for reductions in the prices of the Lawrence Gas & Electric Company. In January last the company voluntarily reduced its maximum rate to 9.45 cents. Last year the company recalled a 7 per cent bond issue and replaced it with a 4.5 per cent issue. It has lately increased its capital stock by about $950,000 and has increased its dividend rate from 8 to 10 per cent, the latter being equivalent to a little over 8 per cent on the stock and premiums. This large increase in stock will materially increase the amount required for dividends over that required for interest on the notes which the new issue of stock replaces. The commission thought the company's prosperity warranted a further rate reduction.

Power Resources of Coquille River, Oregon.—The water supply of the Coquille River basin, Oregon, and its utilization for power and relation to the timber resources have recently been investigated by Interior Department engineers. The studies show that although the head that could be developed on the main four branches of the river is more than 3,200 ft., the stream flow during the greater part of the year is so low that less than 1,500 hp. can be developed during periods of low water. In striking contrast, however, to this small figure, 36,000 continuous horsepower could be produced by utilizing natural storage reservoir sites to regulate the river's flow. The Coquille basin lies between Coos and Umpqua Rivers on the north and east and Rogue River on the south. Its power resources will probably not be utilized until hydro-electric energy can compete with energy generated by steam produced from mill refuse or until the demands exceed the supply of energy that can be so produced. A report prepared by W. G. Hoyt, hydraulic engineer of the Geological Survey, or a copy of it, can be consulted at the main or district offices of the survey.

Alabama Casting Her 23 Votes for Electricity.—The new office building of the Alabama Power Company at Birmingham, a description and views of which have appeared in the ELECTRICAL WORLD, is now adorned with a statue designed to represent the State of Alabama, though called also "Miss Electra." The statue, which was designed and modeled by Edward Field Sanford, Jr., of New York, is made of bronze covered

with goldleaf and is 16 ft. 6 in. from head to foot, 23 ft. over all. Lightning bolts are clasped in both hands.

Michigan City-South Bend Transmission Line Goes Into Commission.—Service was inaugurated on Monday, last over the new 132,000-volt transmission line between Michigan City and South Bend, Ind., which forms an important link in a system connecting the Chicago district with territory to the east. Most of this system is operated at the above voltage. The new line is owned by the Northern Indiana Public Service Company, the largest operating subsidiary of the Midland Utilities Company. It is 55 miles in length. At the Indiana-Illinois state line it is interconnected with similar lines owned by the Commonwealth Edison Company and the Public Service Company of Northern Illinois. These lines are interconnected with the electric generating stations of the Public Service Company of Northern Illinois at Joliet and the Calumet station of the Commonwealth Edison Company. The Northern Indiana Public Service Company's line is carried on steel towers from 75 ft. to 100 ft. in height and is built on a private right-of-way 150 ft. in width the entire distance. By its interconnection with other systems the line forms part of a network reaching Pittsburgh, Cleveland, Toledo and points in West Virginia, Virginia and Kentucky.

Cheat Haven Plant in Partial Operation.—Two of the four 16,000-kw. turbines in the Cheat Haven plant of the West Virginia Power & Transmission Company on the Cheat River are now, it is announced, in full operation; a third is on the point of going into service, and the remaining one will be operating in a month. This hydro-electric plant, of which a view was printed in the ELECTRICAL WORLD for March 27 (page 677), forms part of the West Penn Power Company's system, and 30 representatives of the iron and steel industry in the Pittsburgh area have just completed an inspection of the property. Work on the plant, which has cost $5,000,000, is away ahead of the scheduled date. The plans for the ultimate development of Cheat River include nine dams and an output of approximately 400,000 kw.

General Electric's Big New Signs.—An illuminated sign 170 ft. long, with letters 10 ft. high and surmounted by a monogram 36 ft. in diameter, has been erected at the General Electric Company's Schenectady plant. The top of the monogram is 65 ft. above the roof of the building on which it is erected. Fifteen hundred 25-watt "Mazda" blue sign lamps on 6-in. centers were used in the installation. With this close arrangement of the lamps an unbroken line is maintained when the sign is viewed at night from short distances. The letters are of baked porcelain enameled steel manufactured by the Federal Electric Company and are bordered by a 2-in. navy-blue stripe. The sign is on the newest building of the Schenectady works, adjacent to the main entrance, where it is easily seen from the business section of the city, the main tourist highway and from the New York Central Railroad tracks. It will burn 2,000 hours a year. Similar although smaller signs are being erected at the Pittsfield plant, and one has been erected at the River works, West Lynn, Mass.

Progress on Central Maine Power's Gulf Island Plant.—Work on the Gulf Island hydro-electric development at Lewiston, Me., has so far progressed that the installation of the three 9,000-hp. units in the generating station will begin July 6, according to H. L. Baker of the Central Maine Power Company, resident engineer in charge of operations. This development will be ready on scheduled time, which calls for completion early next year. The over-all length of the power house, which will be faced with yellow brick and will form part of the dam proper, is 149 ft. It is 42 ft. shorter than the company's Deer Rips station, about a mile below on the same river, although the new station will have a much higher rating. The operating head of the dam will be 50 ft., while from the lowest to the highest part will be 115 ft. It will impound a lake about 9 miles long and a mile wide at its widest point. The Central Maine Power Company will, it is expected, build a 33,000-volt transmission line between Augusta and Rockland, as well as transmission lines to Lewiston and rural extensions.

Men of the Industry

J. K. Buchanan Resigns

J. K. Buchanan, vice-president and general manager of the West Virginia Utilities Company and the Wheeling Public Service Company of Morgantown and Wheeling, W. Va., has resigned. The resignation was announced from the office of the Southern Cities Utilities Company, the parent organization. Mr. Buchanan had been affiliated with these properties since 1904, when he entered the employ of the Union Utilities Company, Morgantown, then directed by Harry Warfield as executive officer. Later the Union Utilities became the West Virginia Traction & Electric Company and its ownership passed into the hands of Eastern interests. A receivership existed during the wartime, but it was lifted on April 1, 1920, and the property together with that at Wheeling was purchased in 1921 by Anderson & Company of Providence, R. I. Mr. Buchanan advanced steadily until he was appointed general superintendent, which position he held up to 1925, when he was elected vice-president and general manager.

C. C. Gillette, formerly research manager of the Pittsburgh Railways, has been named vice-president and general manager in charge of operation of the Wheeling Public Service Company to succeed Mr. Buchanan. Mr. Gillette is a native of Rochester, N. Y., and a graduate of Bucknell University in electrical engineering. Before identifying himself with the Pittsburgh Railways in 1921 he was affiliated with the Westinghouse Electric & Manufacturing Company.

John Conroy has been appointed sales manager of the Union Light & Power Company, Franklin, Mass., following L. A. Fiorani, who was recently made manager of the property.

Lee de Forest, inventor, received the honorary degree of doctor of science from Yale University at the commencement exercises June 23 for his extraordinary contributions to electrical science.

Major Glen E. Edgerton, chief engineer of the Federal Power Commission, has been selected by that body to represent it at the tri-annual congress of the Permanent International Association of Navigation Congresses, which is to meet in Cairo, Egypt, in December.

W. A. Kitchen has been placed in charge of the engineering department of the Oklahoma Gas & Electric Company, including the record department, drafting department and general engineering work.

Charles L. Rice has been appointed works manager of the Western Electric Company's Hawthorne Works in Chicago in charge of all the company's manufacturing functions there. Mr. Rice succeeds to the position formerly held by C. G. Stoll. He entered the service of the company in 1902 at the New York plant and after several promotions was sent to London to take charge of the company's allied plant there. Returning to this country three years later, he became superintendent of the production branch at the Hawthorne works. In 1923 he was made assistant works manager in charge of the production, inspection and clerical branches, the position from which he has just been promoted.

K. E. Van Kuran Leaves the Westinghouse Company

K. E. Van Kuran, one of the most popular men in the electrical industry in southern California and for the past twelve years district manager for the Westinghouse Electric & Manufacturing Company in Los Angeles, has resigned. Temporarily Mr. Van Kuran will devote a portion of his time to the Iona Company, manufacturer and seller of health appliances.

Mr. Van Kuran entered the employ of the Westinghouse Electric & Manufacturing Company as a college apprentice following graduation from the University of Washington and at the end of two years' apprenticeship became a member of the headquarters sales department, occupying various sales engineering positions. In the fall of 1911 he removed to the Los Angeles district office of the company as assistant district manager and was appointed district manager in 1915, which position he has occupied continuously since that date. His usefulness as a citizen of southern California was by no means limited to his service to his company, as he has held numerous positions of responsibility in various civic and professional organizations, including the Electric Club, the California Electric Bureau, Pacific Coast Electrical Association and on important committees of the Los Angeles Chamber of Commerce.

K. E. VAN KURAN

Nathan A. Bowers, at the present time Pacific Coast editor of *Engineering News-Record*, a McGraw-Hill publication, and some years ago editorial representative at Vancouver, B. C., for the ELECTRICAL WORLD and other McGraw-Hill publications, received the degree of doctor of philosophy from Stanford University. As part of the requirements, Mr. Bowers submitted a thesis on "Engineering Failures in the Water Power Field," a subject he was well qualified to discuss because during his journalistic career he has specialized on hydro-electric developments.

Obituary

Charles E. Scribner

Charles E. Scribner, engineer and inventor, died at his summer home in Jericho, Vt., June 25. Mr. Scribner was a lifelong friend of Thomas A. Edison's and had been one of America's most prolific inventors, holding nearly 500 patents. Although his principal inventions related to telephone apparatus, at one time earlier in his career he gave attention to other electrical devices, including generators and arc lamps. Mr. Scribner had been associated with the Western Electric Company for 40 years and had served as chief engineer for 22 years when in 1916 he asked to be relieved of his executive duties to become consulting engineer for the company. He was born in Mount Vernon, Ohio, in 1858 and in 1876 entered upon his career in the electrical industry as an employee of the Western Electric Manufacturing Company, the name of which was changed to the Western Electric Company in 1882. Mr. Scribner was a fellow of the American Institute of Electrical Engineers and served as a vice-president from 1913 to 1915.

W. S. Whistler, manager of the Shawnee district of the Oklahoma Gas & Electric Company, died June 19 in the Municipal Hospital in Shawnee as a result of typhoid fever.

Prof. John J. Flather, head of the department of mechanical engineering at the University of Minnesota, died suddenly May 14 at his home in Minneapolis. Professor Flather's teaching career began in 1888, when he became instructor in mechanical engineering at Lehigh University, where he remained for three years. In 1891 he went to Purdue University, spending seven years at that institution as professor of mechanical engineering before joining the staff of the University of Minnesota, where he was active as professor of mechanical engineering up to the time of his death. In the meantime he had established a consulting engineering practice, did considerable research work and was a prolific writer. His consulting engineering work covered some of the important projects of the Northwest from 1891 down to the present time, including municipal water works, electric light plants, power plants and factories. Professor Flather was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Society of Industrial Engineers, secretary and vice-president of Section D of the American Association for the Advancement of Science, and had served as treasuer and vice-president of the Society for the Promotion of Engineering Education.

Commission Rulings

Commission Has Jurisdiction Over Charges for Electricity Made by Landlords to Tenants.—Acting on a decision by the State Attorney-General that tenants who buy electrical energy from the owners of buildings are entitled to have the reasonableness of the rates they pay determined by the state regulatory body, the Indiana Public Service Commission has assumed jurisdiction over such sales. Owners of large factory buildings, office buildings and apartment houses have bought electrical energy and retailed it to tenants on rates agreed on between lessor and lessee without complying in any way with the provisions of the law regulating public utilities. In some instances, it is said, property owners are charging higher rates than tenants would have to pay if the electricity were bought directly from the power companies by the tenants. Henceforth the consumers of such service will be entitled to have the reasonableness of the rates paid determined by the commission.

Commission Protects Company Furnishing Adequate Service After Expiration of Franchise.—The New York Public Service Commission has denied a petition of the Malone Light & Power Company for approval of franchises to permit it to serve the village of Chateaugay, already served by the Chasm Power Company. The commission found that public convenience and necessity did not require the construction of a new distribution system which would duplicate a system already in existence. The commission pointed out that it had no power to pass upon the validity of the Chasm Power Company's franchise rights, the only question for it to determine being that of convenience and necessity. The village of Chateaugay granted a franchise to the Chasm Power Company in 1902 for a period of twenty years, and since its expiration the company has continued its service. The commission said: "An existing electrical corporation is and for more than twenty years has been furnishing electric service in the village of Chateaugay. There is no question with respect to its ability to continue to furnish such service and any probable increased demand for service in that village. In 1921 this commission prescribed the just and reasonable rates which might be charged for such service. The existing company obeyed the order of the commission and in January of this year reduced its rates below those prescribed by the commission. No contention has been or is made that its system is inadequate or unsafe or not modern. That part of its electric system in the village of Chateaugay constitutes the most important part of its entire system. It has more consumers in that area, furnishes more service there, for which it receives greater compensation than in any like area in the territory by it served. Its right to continue to furnish the service is challenged, not by the village in which the service is furnished, but by another electrical corporation which desires to enter the field and to construct another electric plant, thus duplicating existing facilities which seem adequate to meet the present and prospective future needs. The village authorities have taken no action to require the existing company to cease the furnishing of service. . . . In the light of the facts about which there can be no dispute, we cannot find that it is necessary and convenient for the public service that an additional electric plant be constructed in the village of Chateaugay."

Guarantee Deposit Is Proportioned to Size of Bills.—The Southern California Edison Company, which had been requiring residence consumers not satisfactorily establishing credit to guarantee payment of bills by making cash deposits ranging from $1.50 for houses of four rooms or less to $5 for eight or more rooms, asked permission to require a uniform deposit of $3.50 regardless of the size of the residence. The commission, finding that the average monthly bills of 60 per cent of the consumers making deposits did not exceed $1.25 and that only 15 per cent had bills in excess of $2 a month, refused its assent, citing also the further fact that the company may demand a deposit of twice the size of the average monthly bill before reconnecting service discontinued for non-payment of bills; but the schedule was changed to $2.50 for seven rooms or less and $5 for eight rooms or more.

Recent Court Decisions

Court Cannot Direct Commission to Make a Specified Order.—In Henderson County vs. Chicago, Burlington & Quincy Railroad Company, the Supreme Court of Illinois made a finding on the respective powers of courts and commission in that state, saying that the Circuit Court must remand a cause to the Commerce Commission if the latter body failed to receive evidence properly offered with directions to receive such evidence. If the court finds the commission's decision unlawful or unreasonable, it should remand the case for further proceedings, but specific directions as to the order the commission should make or finding as to the matter to be determined by it should not be included in the order of remand. (151 N.E. 541.)*

Franchises and Indeterminate Permits in Indiana.—The Indiana Supreme Court has ruled definitely that when a public utility company surrenders its municipal franchise and accepts an indeterminate permit from the Indiana Public Service Commission all the rights, powers and duties which existed under the franchise in favor of either party to it are entirely abrogated. This has been a moot question in Indiana since the passage of the law creating the commission. The case arose in South Bend, where the franchise of the Chicago, South Shore & South Bend Railway Company, an interurban line, permitted it to operate in La Salle Avenue, but restricted it from running freight trains there except as might be provided by city ordinance. After citizens had filed a suit for alleged violation of this clause the company surrendered its franchise and took out a permit from the Public Service Commission. Attorneys of the company took the position that the surrender of the franchise abrogated all restrictions and that the company was at liberty to operate freight trains under a law which gives interurban railways that right. The property owners contended that the surrender of the franchise affected only such matters as fares, charges and character of service and did not affect the use of the street. The Supreme Court now holds that the surrender completely wiped out the franchise and that the only thing which remained was the right of the company to use the street for the operation of its line. It pointed out that the city took no action after the surrender of the franchise to regulate by ordinance the use of the street.

Company, However Negligent, Not Liable for Death of One Who Unnecessarily Puts Himself in Danger.—The St. Louis Court of Appeals has held, in Gray vs. Union Electric Light & Power Company, that although the plaintiff by showing that the company's wire was down and lying on the highway made out a *prima facie* case of negligence, none the less the evidence that a man killed by contact with the wire and for whose death his heirs sought to recover deliberately attempted to cut the wire with a hatchet without any necessity existing for his intervention, and although, as a practical electrician, he knew or should have known of the danger thus incurred, set up so clear a case of contributory negligence that no damages should have been assessed. (282 S. W. 490.)

Violation of Commission Orders Because of Unconstitutionality of Part of Act Affecting Appeal Is Condemned.—The Supreme Court of Colorado held, in Greeley Transportation Company vs. People, that, although a provision of the public utilities act taking away from district courts any jurisdiction over appeals from decisions of the Public Utilities Commission had been found unconstitutional, this fact did not affect the validity of the remainder of the act, and that the position that the validity of the proceedings of the commission can only be indirectly reviewed by violating its orders and testing that validity in an action to impose heavy penalties or punish for contempt, and at the risk of incurring those penalties if unsuccessful, is untenable. (245 Pac. 720.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Irregular

Check to Forward Movement in General List Brings a Sympathetic Check in Utility Companies

POWER and light stocks during the week under review moved very much with the general market, where, incidentally, the forward movement of the week before was at least for the time definitely checked. Considering that the general stock averages had been advancing for nearly a month, the hesitation in the trading of last week was a natural development. Money conditions remain easy and the reports of trade and industry in the main are favorable, but speculators fail to see in the market any incentive for participation on a big scale.

On the New York Stock Exchange American Water Works & Electric, Public Service Corporation of New Jersey, Standard Gas & Electric and the North American Company stocks moved within narrow limits. Changes on the New York curb market and in the over-the-counter issues were relatively small, and net declines and advances for the week, although generally small, were found in about equal number.

Among the stocks that improved their positions by approximately a point were Arkansas Light & Power preferred, Arkansas Central Power preferred, Associated Gas & Electric 6 per cent preferred, Birmingham Electric preferred, Colorado Power preferred, Commonwealth Edison, Mississippi Power & Light preferred, Nebraska Power preferred, Electric Bond & Share preferred and United Light & Power, class A.

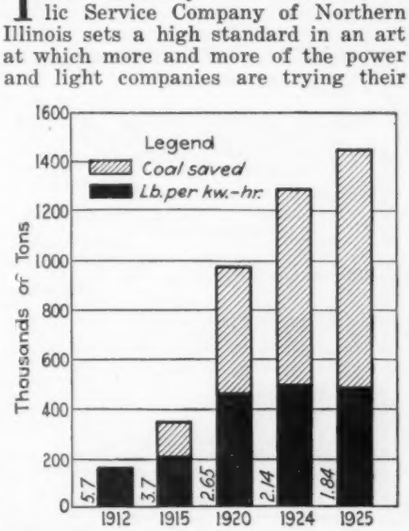
On the other hand, losses were suffered by American Public Utilities, American Light & Traction, Commonwealth Power and Electric Bond & Share.

Public Service Company of Northern Illinois

Gross Revenues Have Risen from the Sum of $5,000,000 in 1912 to $21,000,000 in 1925

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

THE new 1926 year book of the Public Service Company of Northern Illinois sets a high standard in an art at which more and more of the power and light companies are trying their hand. In an effort to make the book readable for the layman the company has not left out any of the financial statements so essential to an analysis of affairs by the expert.



ELECTRIC STATION COAL CONSUMPTION OF PUBLIC SERVICE COMPANY

The Public Service Company of Northern Illinois, one of the most prosperous systems in the Insull group, serves somewhat more than a tenth of the total area of the state. It serves even a larger proportion than that of the population. The system is now interconnected with the transmission systems of the Commonwealth Edison Company, the Northern Indiana Gas & Electric Company, the Central Illinois Public Service Company, the Illinois Northern Utilities Company and the Central Illinois Light Company.

Samuel Insull, chairman of the board, says: "On account of the large power resources of these various systems we become an integral part of the 'greatest pool of power in the world' and form with further interconnections a part of the vast superpower system extending from the upper peninsula of Michigan, through Wisconsin, Illinois, Indiana, Kentucky and into Virginia. Interconnected lines are now in service between Twin Falls, Mich., and Pocket, Va., a total distance of some 800 miles. Our territory forms about the best territory surrounding any large center of population, with the exception of that surrounding the city of New York. The development must necessarily go along and keep pace very largely with the development within the city of Chicago."

From a total of $4,230,000 for the fourteen months ended Dec. 31, 1912, gross revenues of the Public Service Company of Northern Illinois have risen persistently until in 1925 they reached $20,646,820. Of the latter sum operating expenses in 1925 consumed $12,210,152, so that net operating revenues totaled $8,436,668. Further de-

Company Reports

Name of Company	Gross Earnings for May 1926	1925
Bangor Hydro-Electric	$121,700	$115,397
Binghamton Lt., Ht. & Pwr.	143,911	128,015
Central Illinois Light	321,667	303,452
Columbia Gas & Electric	3,005,003	2,705,789
Commonwealth Power	3,845,885	3,470,085
Consumers Power	1,881,668	1,615,604
Electric Power & Light	3 903 801	3 531,711
Florida Public Service	136,242	76,989
General Gas & Electric	1,894,849	1,627,238
Idaho Power	251,598	261,247
Illinois Power	187,172	183,618
Kansas City Power & Light	819,694	803,613
Manchester Trac., Lt. & Pwr.	221,223	198,108
Metropolitan Edison	736,024	676,816
New Bedford Gas & Edison Lt.	337,885	324,100
New Jersey Power & Light	184,776	97,980
North Carolina Pub. Serv.	156,959	153,275
Northern Ohio Power	875,714	941,541
Ohio Edison	129,219	114,985
Portland Electric Power	945,609	915,378
Public Service of N. J.	8,481,722	7,605,968
Republic Railway & Light	1,002,903	890,485
Sayre Electric	22,885	21,102
Southern Canada Power	107,637	95,713
Southern Indiana Gas & Elec.	230,647	210,461
Tennessee Electric Power	986,089	945,083
Washington Water Power	493,109	439,862
Winnipeg Electric*	450,773	427,400

* April.

Dividends Declared

Name of Company	Per Cent	When Payable
Adirondack Power & Light, com.*	.10	June 30
Adirondack Power & Light, 8% pf.	2	July 1
Adirondack Power & Light, 7% pf.	1¾	July 1
American Electric Power, pf.	$1.75	Aug. 2
Anaconda Copper Mining	.75	Aug .23
Arizona Power, 8% pr. pf.	2	July 1
Arizona Power, 7% pf.	1¾	July 1
Arkansas Light & Power, pf.	1¾	July 1
Buffalo General Elec., com	.25	June 30
Buffalo General Elec., pf.	.40	June 30
California Electric Generating, pf.	1½	July 1
Canadian Westinghouse	2	July 1
Central Power, pf	1¾	July 15
Cin., Newp. & Cov. Lt. & Trac., com	1½	July 15
Cin., Newp. & Cov. Lt. & Trac., pf.	1¾	July 15
Columbia Gas & Elec., com	$1.25	Aug. 16
Columbia Gas & Elec., 7% pf. A	1¾	Aug. 16
Commonwealth Edison, cap	$2	Aug. 2
Commonwealth Gas & Elec. Cos., pf	$1.50	July 15
Commonwealth Power, pf	$1.50	Aug. 2
Commonwealth Power, com	.50	Aug. 2
Consumers Power, 6% pf	$1.50	Oct. 1
Consumers Power, 6.6% pf	$1.65	Oct. 1
Consumers Power, 7% pf	$1.75	Oct. 1
Consumers Power, 6% pf.*	.50	Aug. 2
Consumers Power, 6% pf.*	.50	Sept. 1
Consumers Power, 6% pf.*	.50	Oct. 1
Consumers Power, 6.6% pf.*	.55	Aug. 2
Consumers Power, 6.6% pf.*	.55	Sept. 1
Consumers Power, 6.6% pf.*	.55	Oct. 2
Dominion Pwr. & Trans., pf.	1¾	July 15
Eastern New Jersey Pwr., pf.	2	July 1
Empire Power, $6 pf.	$1.50	July 1
Empire Power, ptc. stk	.40	July 10
Fall River Electric	.50	July 1
Georgia Lt., Pwr. & Rys., pf.	1¾	July 1
Greenfield Elec. Lt. & Pwr., com.	$2.50	June 30
Greenfield Elec. Lt. & Pwr., pf.	.37	June 30
Illinois Northern Utilities, pf.	1¾	Aug. 2
Johns-Manville	.75	July 1
Mississippi Power & Light, pf.	2	July 1
New Orleans Public Service, pf.	$1.75	July 1
Northern Canada Pwr.	¾	July 10
Ohio Brass, com	$1	July 15
Ohio Brass, pf	1¾	July 15
Ontario Lt. & Pwr., com	1	July 25
Ontario Lt. & Pwr., pf	3	July 25
Penn-Ohio Edison, 7% pr. pf.	1¾	Sept. 1
Public Service of No. Ill., com. ($100 par)	$2	Aug. 2
Public Service of No. Ill., com., no par	$2	Aug. 2
San Diego Cons. Gas & Elec., 7% pf.	1¾	July 15
Southern California Edison, orig. pf.	2	July 15
Southern Cities Utilities, com.	.75	July 10
Southern Cities Utilities, pf.	.58⅓	July 10
Texas-Louisiana Power	1¾	July 1
United Gas & Elec., 5% pf.	2½	July 15
Virginia Ry. & Pwr., pf.	1¾	June 21
West Kootenay Power, pf.	1¾	July 2
Wheeler Condenser & Engr., 1st & 2d pf	2	July 1
Wisconsin River Power, pf.	1¾	Aug. 20
Worcester Electric Light	$1	June 30

*Monthly.

ductions, principally for taxes, brought the net operating income down to $6,826,263, which, after making a small addition for other income, made the gross income of the company for the year $7,626,884. After payment of interest on the funded debt, a charge that took $2,863,378, the company reported $4,146,549 available for dividends.

The following excerpt from the report will indicate the results of the company's efforts to reduce operating costs through economies in the use of coal: "A new record for electric generating efficiency was established at the Waukegan generating station, where the average coal consumption per kilowatt-hour during the month of December was reduced to 1.45 lb. The performance for this station for the entire year 1925 averaged 1½ lb. of coal per kilowatt-hour. The importance of this record becomes apparent when it is compared to the average coal consumption of 3.8 lb. of coal per kilowatt-hour in the company's plants during 1914. Since 1912 the saving in coal from this type of efficiency amounts to about 993,000 tons."

Utility Financing Active

Central-Station Companies Raise $725,486,442 During First Half of Year

NEW stock, bond and note offerings of the electric light and power companies of the country during the first six months of 1926 amounted to $725,486,442 as compared with $584,968,500 for the similar period of 1925. To this sum June contributed $164,925,000 against $66,316,000 for the month of May and $92,395,500 for the month of June, 1925.

The largest individual loan was floated by the Southern California Edison Company in the form of refunding mortgage gold bonds to the amount of $40,000,000. Long-term financing again predominated and attention is called to the prominent part taken by refunding operations. The rate of return yielded the investor, which has been on the up-grade since March, receded to the 5.39 per cent mark in June from the 5.95 per cent mark in May.

New Capital Issues.—During the past week 20-year 6-per-cent gold debentures of the Public Service Company of Colorado to the amount of $6,000,000 were offered at 99 and interest, to yield

Security Issues of Electric Service Companies in June

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Ohio River Edison Co.	$4,000,000	25	First mortgage sinking-fund gold bonds	Extensive additions	5	93½	5.50
	1,600,000	..	Cumulative guaranteed preferred stock		7	100½	6.95
San Diego Consolidated Gas & Electric Co.	2,500,000	21	First and refunding mortgage gold bonds, series B		5	98½	5.10
Detroit Edison Co.	15,000,000	29	General and refunding mortgage gold bonds, series B	To reimburse for expenditures for improvements and extensions	5	101½	4.90
Electrical Securities Corp.	1,000,000	30	Collateral trust sinking-fund gold bonds		5	98½	5.10
Kentucky Electric Power Corp.	1,100,000	25	First mortgage gold bonds, series A	Betterments, extensions and for other corporate purposes	6	99	6.05
Southern California Edison Co.	40,000,000	25	Refunding mortgage gold bonds.	To retire bonds, to reimburse company for expenditures made for payments of bonds and for additions	5	98½	5.10
Cities Service Co.	5,000,000	40	Refunding gold debenture bonds	Refunding	6	93½	6.45
Wisconsin Power & Light Co.	1,000,000	30	First lien and refunding mortgage gold bonds, series E	To reimburse for property acquired, for expenditures on additions and for other corporate purposes	5	95	5.33
Southeastern Power & Light Co.	12,500,000	99	Gold debentures, series A	To reimburse company for expenditures on acquisition of properties and to provide funds for other corporate purposes	6	95	6.30
Portland Electric Power Co.	3,750,000	25	First lien and refunding mortgage gold bonds, series C	To reimburse for acquisition of properties, additions and extensions, for the retirement of debt and for other corporate purposes	5½	97	5.70
Nevada-California Elec. Corp.	23,000,000	30	First trust mortgage gold bonds	To retire bonded debt, to defray cost of new construction and for general corporate purposes	5	95½	5.30
Public Service Corporation of New Jersey	15,000,000	30	Secured gold bonds	To reimburse treasury for advances previously made for additions and betterments and for other corporate purposes	5½	99	5.57
Savannah Electric & Power Co.	1,700,000	3	Gold coupon notes	Additions and to retire floating debt	5	99½	5.25
Indiana-Ohio Public Service Co.	600,000	20	First mortgage gold bonds, series A		6	100	6
Ohio Power Co.	9,635,000	30	First and refunding mortgage gold bonds	To provide funds in connection with the purchase of properties, to reimburse the company for capital expenditures and for other corporate purposes	4½	93	4.95
Cumberland County Power & Light Co.	9,000,000	30	Fisrt mortgage gold bonds	To retire all outstanding bonds, to reimburse for construction expenditures and to provide an adequate medium for future financing	4½	94½	4.85
Long Island Lighting Co.	1,500,000	29	First refunding mortgage gold bonds, series B	Additions, extensions and improvements to the properties of the company	5	100	5
Central Illinois Public Co.	1,230,000	30	First mortgage and refunding gold bonds, series E	To partially reimburse the company for additions, extensions and improvements, and for other corporate purposes		96	5.25
East Coast Utilities Co.	250,000	1	Collateral gold notes	Extensions, additions, new construction and other capital expenditures	5	99	6.04
Northern Connecticut Power Co.	985,000	..	Cumulative preferred stock		6½	98½	6.60
Texas-Louisiana Power Co.	850,000	..	Cumulative preferred stock	To reimburse for expenditures for improvements, for payment of obligations incurred through acquisition of properties, for retirement of debt and for additional working capital	7	95	7.37
Tennessee Electric Power Co.	3,500,000	30	First and refunding mortgage gold bonds	Additions	5	98	5.10
Pennsylvania Power Co.	3,800,000	30	First mortgage gold bonds	To pay for constituent properties, to cancel indebtedness and to reimburse for construction expenditures	5	98	5.10
Central Power & Light Co.	3,000,000	..	Cumulative preferred stock	To reimburse for expenditures made in acquisition of properties, and to provide working capital for other corporate purposes	7	97½	7.17
Interstate Power Co.	1,425,000	..	Preferred stock	To reimburse for expenditures on additions and for other corporate purposes	7	95	7.37
Columbus Electric & Power	2,000,000	3	Gold notes		5	99½	5.05
Total	$164,925,000						

over 6 per cent. Proceeds will be used to retire 7 per cent debentures amounting to $1,949,900, for the acquisition of additional properties, to reimburse the treasury for properties already acquired, for additions and betterments and for other corporate purposes. The Northern Indiana Public Service Company took part in the week's financing to the extent of $2,500,000 in the form of 6 per cent cumulative preferred stock priced at $92.50 per share and accrued dividend to yield approximately 6.50 per cent. A foreign loan appeared among the week's flotations, a fifteen-million-dollar issue of general and refunding mortgage guaranteed gold bonds of the Saxon Public Works, Inc. These bonds, dated May 1, 1926, and due May 1, 1951, are priced at 91½ and interest, yielding 7.24 per cent. Saxon Public Works, Inc., and its subsidiary, Electric Power Works of West Saxony, own and operate one of the most extensive and modern systems in Germany for the generation, transmission and distribution of electrical energy. Of the present issue, $4,000,000, aggregate principal amount, has been withdrawn for offering in European markets.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday June 26	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 76	70¾	84¾
Adirondack Pwr. & Lt.—7% pf.	k104½	....	....
Adirondack Pwr. & Lt.—8% pf.	113	101	115
Ala. Pwr., pf.	k107	....	....
Allis-Chalmers Mfg. pf.	108½	105	110½
Allis-Chalmers Mfg., com.	k 86½	78½	94½
Aluminum Co. of Amer., com.	k 73	....	....
Aluminum Co. of Amer. new, pf.	k100	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	k 89½	89	98
Amer. & Foreign Pwr., com.—no par	k 22½	15½	42¾
Amer. Bosch Magneto, com.—no par	k 21½	16	34¾
Amer. Brown, Boveri, Elec.	k 41½	30½	48
Amer. Brown, Boveri, Elec., pf.	k 95	86½	97
Amer. Elec. pwr , pf.	m110½	102½	111½
Amer. Gas & Elec., 6% pf.—no par.	k 94	90½	95½
Amer. Gas & Elec., com.—no par.	k 86½	64	99¾
Amer. Lt. & Trac., 6% pf.	106½	105	115½
Amer. Lt. & Trac., com.	k212	195	263
Amer. Pwr. & Lt., 6% pf.	k 94	92	96
Amer. Pwr. & Lt., com.—no par.	m 56½	50½	56½
Amer. Pub. Serv., 7% pf.	92	92	97½
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	k 87	90½	90½
Amer. Pub. Utilities, 7% pf.	k 94	89	96
Amer. Pub. Utilities, com.	k 70	....	....
Amer. States Sec., A.	k 3½	....	....
Amer. States Sec. B.	k 2½	....	....
Amer. Superpwr., pf.—25	24½	23	26½
Amer. Superpower, pf.	92½	90	94
Amer. Superpwr., Class A—no par.	26	19½	37¾
Amer. Superpwr., Class B—no par.	27½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	107	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 57½	43¾	74
Anaconda Copper.	k 47½	41¼	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	102
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 70	....	....
Arkansas Cent. Pwr., pf., $7—no par	k104	....	....
Arkansas Lt. & Pwr., 7% of	k100½	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	l 105½	100½	106½
Assoc. G. & E., pf.—$3.50—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 84	....	....
Assoc. Gas & Elec., Class A—no par	k30½	25½	35½
BABCOCK & WILCOX, com.	k116	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	105	110
Birmingham Elec. pf.—$7—no par.	k106½	....	....
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50.	98½	....	....
Blaw-Knox, com.	m 51	45	56
Brazilian Trac., Lt. & Pwr., com.	f 97½	....	....
Broad River Pwr., pf.	k 93½	....	....
Brooklyn Edison, com.	k141	133	146½
Buffalo, Niagara&East.Pwr.,pf.—25.	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	k 28½	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	89	95
California Ry. & Pwr., pf.	m105	88	115
Carolina Pwr. & Lt., pf.—$7—no par	k106	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 92	89½	95
Cent. & S. W. Ut., pr. ln. pf.—no par	a 95	93	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	98	99	99½
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	87	87	93½
Central Pwr. & Lt., pf.	k 97½	....	....
Central States Elec., 7% pf.	k 91	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m114	110	116
Chicago Fuse Mfg., com., no par.	a 31½	30	35
Cincinnati Gas & Elec., com.	g 89	88	93½
Cities Service, 6% pf.	k 85½	....	....
Cities Service, pf.B—10.	k 7½	....	....
Cities Service, pf. BB—100.	k 74	....	....
Cities Service, com.—20.	k 41½	....	....
Cities Service, Bks. Shrs.—10.	k 20½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	107	103	108
Cleveland Elec., Illg., com.	250	240	250
Colorado Pwr., 7% pf.	95	96	97
Columbia Gas & Elec., 7% pf.	115	112	115
Columbia Gas & E., com.—no par.	k 82½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	k103	....	....
Columbus Elec. & Pwr., com.	k265	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98	98	99½
Columbus Ry., Pwr. & Lt., pf. B.	93	92	97
Col. Ry., Pwr. & Lt., com.—no par.	75	75	85
Commonwealth Edison, com.	a143½	137½	145
Commonwealth Pwr., 6% pf.	86½	82	87½
Commonwealth Pwr., com.—no par.	k 37½	28½	42¾
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	107	108	113
Cons. Gas of N. Y., pf.—50.	k 58	....	....
Cons. Gas of N.Y., com.—no par.	k 97½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e110½	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 51	45	57½
Cons. Pwr. & Lt., 7% pf.	105	100	107
Consumers Pwr., 6% pf.	97	95	98
Consumers Pwr., 6.6% pf.	103½	101½	103½
Continental Gas & Elec., 7% pfc. pf	102	96	109½
Continental Gas & Elec., 7% pr. pf.	96	95½	98½
Continental G.&E., con.—no par.	130	85	150
Croker Wheeler, com.	k 18	....	....
Croker Wheeler, pf.	k 55	....	....
DALLAS PWR. & LT., 7% pf.	k106	....	....
Dayton Pwr. & Lt., 6% pf.	k 99	....	....
Detroit Edison, com.	133½	123½	141½
Dubilier Condenser & Rado, com.—no par.	6	4½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	112	111	113
EAST, N. Y. UTIL, pf.	93	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	k 14	....	....
Eastern States Power, pf.	87	89	95
Eastern Tex. Elec., 7% pf.	k103	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d225	207	250
E. Paso Elec., com.—no par.	70	70	94
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l 107	103½	107½
E. Bd. & Share Sec., com.—no par.	l 70	56½	86
El. Household Util.	a 15	13½	25
Elec. Investors, 6% pf.—no par.	k 91	....	....
Elec. Investors, com.—no par.	k 40½	30½	74½
Elec. Investors, 10% pd. receipts	20	12	56
Elec. Pwr. & Lt., ctfs. pf.	k 94½	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	105	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	107	103	110½
Elec. Pwr. & Lt., ctfs., com—no par.	k 20½	15½	34½
Elec. Ry. Securities, com.—no par.	m 6	4½	10
Elec. Refrig.	k 76½	62½	78½
Elec. Storage Batterr, com.—no par.	k 84½	71½	86½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec., pf.	m103	100	104½
Empire Dist. Elec., 6% pf.	m87	87	87
Empire Power, A.	30	21	32
Engr. Pub. Serv., pf.—no par.	k104½	97	104½
Engr. Pub. Serv., com.—no par.	k 23	21	29¾
Eureka Vac. Cleaner, com.—no par.	k 51½	43	53½
FAIRBANKS MORSE, pf.	111	108½	115
Fairbanks Morse, com.—no par.	k 51	46	59½
Federal Lt. & Trac., com.	k 32½	28	39½
Federal Light & Traction, pf.	86½	86	89
Federal Utilities, pf.	k 70	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l 107½	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	k 42	....	....
Galveston-Hstn. El., com.	k 13	....	....
Gen. Elec., com.	k343	285	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. Elec., new	k 85½	79	87½
Gen. G.&E., (Del.) com. A no par.	39½	34	59
Gen. G.&E., (Del.) com. B no par.	m 32½	28	49
Gen. G.&E., (Del.) A pf. $8 no par.	109	105½	110½
Gen. G.&E., (Del.) A pf. $7 no par.	100	95	99½
Gen. G.&E., (Del.) pf. B.	94½	92½	96
General Public Service, pf.	105	90	106½
General Public Service, com.	m 13	12½	16½
Ga. Lt., Pwr., & Rys., 6% pf.	86	82	86½
Ga. Lt., Pwr. & Rys., com.	m 57½	56½	73½
Ga. Ry. & Elec., 8% pf.	k111	....	....
Ga. Ry. & Elec., pf.	k103	....	....
Ga. Ry. & Pwr., 4% pf.	k125	....	....
Ga. Ry. & Pwr. com.	130	....	....
Gt. Western Pwr., 7% pf.	k100½	....	....
HAVANA ELEC. UTIL., com.	31½	28	44½
Havana Elec. Util., pf.	m 75	64½	75
IDAHO PWR., 7% pf.	104½	103	104
Ill. No. Utilities, 6% pf.	a 91	90	92
Ill. Pwr. & Lt., 7% pf.	k 99½	....	....
Ingersoll Rand.	91	80½	104
Int. Combus. Engr., com.—no par	k 54½	33½	64½
Int. Utilities, class A—no par.	32½	31	39
Int. Utilities, class B—no par.	5½	4½	9½
Interstate Pwr., pf., no par.	k 93	....	....
Interstate Pub. Serv., 7% pf.	97	96½	99
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	k 96	....	....
Jersey Central Pwr. & Lt., ptc., pf.	102	95½	103
Jersey Central Pwr. & Lt., com.—no par.	45	45	50
Johns-Manville, com.—no par.	k139½	120	159
KANSAS CITY PWR. & LT., pf.	112	107½	112½
Kansas Gas & Elec., 7% pf.	l 101½	99	102½
Kentucky Hydro-Elec., pf.	a 93½	91½	95
Kentucky Sec., 6% pf.	78	75	85
Kentucky Utilities, 6% pf.	92½	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	k104	....	....
Kings County, Ltg., 8% pf.	108	105	110
LACLEDE GAS LT., com.	158½	146	168
Lehigh Pwr. Sec., com.—no par.	k 15	10	23
Long Island Ltg., 7% pf.	k109	....	....
Long Island Ltg., com.—no par.	115	120	150
Los Angeles Gas & Elec., 6% pf.	96	95½	97
Louisville Gas & Elec., Class. A.	k 23½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 77	56	78
Manila Elec., com.—no par.	36½	27½	39½
Maytag Mfg., com.	k 21	19	23½
Memphis Pwr. & Lt., pf., $7, no par	104	103	107
Metro. Edison, pf.—$6—no par.	k 93	....	....
Metropolitan Edison, pf., $7, no par.	105	102	108
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a 108	97½	111½
Middle West Utilities, 7% pr. lien pf.	a116½	106½	123½
Middle West Utilities, com.—no par.	a115	108	134½
Midland Utilities, pr. ln. pf.	a102½	98	104
Midland Utilities pf. A.	a 99½	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	93	....	....
Minn. Pwr. & Lt., 7% pf.	l 103½	100	104
Miss. Pwr. & Lt., pf.	k101	....	....
Miss. River Pwr., 6% pf.	k 95½	....	....
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	k101	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	k 94	....	....
Mohawk Hudson Pwr., com.—no par	k 23½	20½	28½
Montana Pwr., pf.	m114½	112½	119½
Montana Pwr., com.	k 76½	69½	83½
Montreal Pwr., com.	f226½	....	....
Mountain States Pwr. pf.	k 96	....	....
Mountain States Pwr., com.	k 20	....	....
NASSAU & SUFFLOK, LTG., pf.	k 97	....	....
National Carbon, pf.	m127½	125	128
National Elec. Pwr., pf.	a 94	93	96½
National Electric Pwr-A.	a 22	19½	26
Nat. Lt., Ht. & Pwr., com.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k101½	96	102½
National Pwr. & Lt., com.—no par.	k 23½	16½	38½
National Pub. Serv., 7% pf.	k 93	....	....
National Pub. Serv., pfc. pf.	k100	....	....
National Pub. Serv., A com.—no par.	19½	15½	24
National Pub. Serv., B com.—no par.	k 13½	10	17½
Nebraska Pwr., 7% pf.	l 106½	103	107½
Nevada-Calif., Elec., com.	25½	18½	44½
New Brunswick Pwr., pf.	50	30	55
New England Pub. Serv., pr. in. pf.	97	98	99½
New England Pub. Serv., pf.	89	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	110
New Orleans Pub. Serv., 7% pf.	k100½	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	k 87	....	....
N. Y. Central Elec., 7% pf.	96	98	100
Newport News & Hampton Ry., Gas & Elec., com.	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111½
No. Amer., 6% pf.—50.	51½	49	51
No. Amer., com.—10.	k 50½	42	67
No. Amer. Edison pf.—no par.	k 96½	91½	96½
No. Amer., Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	k 91½	....	....
Northeastern Pwr., com.	k 18½	17½	36
No. Indiana Gas & Elec., pf. A.	102	98	103
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	78	81
No. Ohio Trac. & Lt., 7% pf.	85	88	91
No. Ont. Lt. & Pwr., pf.	k 83	....	....
No. Ont. Lt. & Pwr., com.	72	45	70
No. States Pwr., 7% pf.	k102	99½	102½
No. States Pwr. com.	k107½	97	136½
No. Texas Elec., 6% pf.	k 47	....	....
No Texas Elec., com.	k 18	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	101	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	95½	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	k 99	....	....
Ohio River Edison, pf.	k 99½	....	....
Oklahoma Gas & Elec., pf.	k 96	....	....
PACIFIC GAS & ELEC., 6% pf.	k 90	....	....
Pacific Gas & Elec. com.	130	118	132½
Pacific Pwr. & Lt., 7% pf.	l101	98	102
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr. pf.—no par	c 72½	71	91
Penn-Ohio Edison, 7% pf.	k 95½	....	....
Penn-Ohio Elec., 7% pf.	94	93	96

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid. low, high, Tuesday, June 29. *l*Bid, low, high, Wednesday, June 30. *m*Latest quotations available. *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday June 26	Low 1926	High 1926
STOCKS—Continued			
Penn-Ohio Pwr. & Lt., 7% pf.	96½	94	97
Penn-Ohio Pwr., & Lt., 8% pf.	107	100	106
Penn Pwr. & Lt.—$7—no par.	*f*107	103	108
Penn Pub. Serv., 7% pf.	101	96	100
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	*e* 144	141	171
Phila. Co., 6% pf.—50	50	47½	50½
Phila. Co., com.—50	71½	59½	76½
Phila. Elec., com.—25	*e* 48½	41½	67½
Pittsburgh Utilities, pf.—10	19½	14½	20½
Portland Elec. Pwr., 7% pf.	*k* 98	....	....
Portland Elec. Pwr., 6% pf.	*k* 76	....	....
Portland Elec. Pwr., 6% 2nd pf.	*k* 77½	....	....
Portland Elec. Pwr., com.	*k* 32	....	....
Potomac Elec. Pwr., pf.	*f*108	....	....
Pwr. Corp. of N.Y., com—no par.	*m* 79	77½	90½
Pwr. Sec., pf.—no par.	15	19	29
Pwr. Sec., com.—no par.	6	11	13
Pub. Serv. of N. J., 7% pf.	108½	103½	108½
Pub. Serv. of N. J., 8% pf.	119½	115	120½
Pub. Serv. of N. J., com.—no par.	*k* 86½	72	92½
Pub. Serv. of No. Ill., 6% pf.	*a*104½	100½	104½
Public Serv. of No. Ill., 7% pf.	*a*115	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*140	128½	140
Pub. Serv. of No. Ill., com.	*a*139	129½	139
Pub. Serv. of Okla., 7% pf.	94	92	95
Pub. Serv. Elec. & Gas, 6% pf.	101	97	101½
Public Service Elec. Pwr., pf.	111	106	112
Puget Sound Pwr. & Lt., 7% pf.	*k*103	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 83	....	....
Puget Sound Pwr., & Lt., com.	*k* 30½	28	66½
RADIO CORP. OF AM., pf.—50	47½	44½	40
Radio Corp. of Amer., com.—no par	*k* 46½	32	48½
Republic Ry. & Lt., pf.	*k*106½	....	....
Republic Ry. & Lt., com.	*k* 85	....	....
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	*k*101½	....	....
Rochester Gas & Elec., 7% pf.	105	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	97	97½	98½
Safety Cable	*k*51½	42½	54½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	65	60	65
Servel Corp., Class A	*k* 24½	15½	30½
Servel Corp., Class B—no par.	*m* 40	....	....
Sierra Pacific Elec., com.	*k* 28½	23	28½
Sioux City Gas & Elec., 7% pf.	*k*100½	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	100	97	103
Southeastern Pwr. & Lt., ptc. pf.	65	60	67½
S. E. Pwr. & Lt., com.—no par.	*k* 27½	20	46½
So. Calif. Edison, 8% pf.	120	135	140
So. Calif. Edison, 7% pf.	109	110	112
So. Calif. Edison, 6% pf.	98	97½	99
So. Calif. Edison, com.	*m* 31½	30½	32
Southern Cities Utilities, 7% pf.	*k* 89	....	....
Southern Cities Utilities, com.	*k* 44½	....	....
Southwestern Lt. & Pwr., A	*k* 60	....	....
Southwestern Lt. & Pwr., B	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf.	*k* 81	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*101	....	....
Springfield (Mo.) Ry & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.	*k* 55	53½	57½
Standard Gas & Elec., 7% pf.	*k*102	....	....
Standard Gas & Elec., com.—no par.	*k* 56½	51	60
Standard Pwr. & Lt., 7% pf.	*k*102½	....	....
Staten Island Edison, pf.—$6—no par	*k* 95	....	....
Superheater, com.—no par.	*k*156	132	152
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com.	300	260	315
TAMPA ELEC., com., new	51½	48	67
Tenn. Elec. Pwr., 6% pf.	*k* 88	....	....
Tenn. Elec. Pwr., 7% pf.	*k*101½	....	....
Terre Haute, Ind. & East Trac., pf.	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	*f*106	102	106½
Tide Water Pwr., 8% pf.	*k*102½	....	....
Timken Roller Bearing, com—no par	*k* 51½	44½	56½
Toledo Edison, 8% pf.	113	112	114
Toledo Edison, 7% pf.	*k*102	....	....
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	85	87½	89
UNITED GAS & ELEC., 6% pf.	*k* 95½	....	....
United Gas & Elec., com.—no par.	*m* 57	56	66
United Gas & Elec. (N.J.), 5% pf.	*k* 70½	....	....
United Gas Impr.—50	*c*108½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	48	44	51
United L. & P. pf.—$6.50—no par.	85	81	91
United Lt. & Pwr., com., A—no par	*k* 15½	12½	28
United Lt. & Pwr., com., B—no par	*m* 16½	15	31
Utah Pwr. & Lt., 7% pf.	*f*103	99	103½
Utica Gas & Elec., 7% pf.	*k*104½	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	*k* 92	....	....
Utilities Pwr. & Lt., com A	*k* 30½	28½	37
Utilities Pwr. & Lt., com. B—no par.	*k* 15½	14	18½
VERMONT HYDRO - ELEC., 7% pf.	94	95	96
Virginia Elec. & Pwr., 7% pf.	103½	101	103½
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	*b* 67	65½	85
Wagner Elec., com.—no par.	*b* 20½	20	34½
Washington Ry. & Elec., com.	*f*180	....	....
Washington Ry. & Elec., pf.	*f* 88½	....	....
Washington Wtr. Pwr., com.	133	130	136
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf., temp. ctfs.	*m*100	95½	101
West Penn, com.	*m*125	118	130
West Penn Elec., pf.	99	95½	100½
West Penn Elec., Class A.	94½	88½	97
West Penn Pwr., pf.	110½	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	46½	43	46½
Western Pwr., 7% pf.	*k* 93½	91½	99
Western States Gas & Elec., 7% pf.	*k* 90½	....	....
Western States Gas & Elec., com.	*k* 16	....	....
Westinghouse El. & Mfg., com—50	*k* 69½	65	79½
Weston Elec. Instrument, Class A	30½	27½	31½
Weston Elec. Instrument, com.	15½	13½	19
Wheeling Elec., pf.	90	91	93½
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A	70	68	80
Worthington Pump, pf. B	60	53	65
Worthington Pump, com.	*k* 32	20½	44½
YADKIN RIVER PWR., 7% pf.	*f*106	102	106½
Yale & Towne, com.—25	*k* 67	60½	69
BONDS			
ABITIBI PWR. & PAPER	6s	1940 101½	100 102½
Adir. Elec. Pwr.	5s	1962 101½	100½ 101½
Adir. Pwr. & Lt.	6s	1950 *k*105½	....
Adir. Pwr. & Lt.	5s	1930 97½	97 99
Ala. Pwr.	5s	1946 101	99 101
Ala. Pwr.	5s	1951 99½	97 100½
Ala. Pwr.	6s	1951 104½	104½ 105½
Ala. Trac., Lt. & Pwr.	5s	1962 *m*111	112 124
Aluminum Co. of Amer.	7s	1933 *k*106½	106½ 107½
Amer. Gas & Elec.	5s	2007 99	92 99
Amer. Gas & Elec.	6s	2014 *k*100½	98 101½
Amer. Pwr. & Lt.	6s	2016 *k* 99½	96 100½
Amer. Pub. Serv.	6s	1942 101	98½ 101
Amer. Wtr. Wks. & Elec.	5s	1934 *k* 97½	....
Amer. Wtr. Wks. & Elec.	6s	1975 *k* 95½	92½ 95½
Anaconda Copper	6s	1929 103	102½ 103½
Anaconda Copper	6s	1953 *k*103½	....
Anaconda Copper	7s	1928 *k*106½	....
Appalachian Pwr.	5s	1941 *k*100½	....
Appalachian Pwr.	6s	2024 98	93½ 99½
Appalachian Pwr.	7s	1936 107	105 108
Arizona Pwr.	6s	1933 100½	99½ 101
Arizona Pwr.	6s	1947 96½	95½ 97
Ark. Central Pwr.	6s	1948 102	102 103½
Ark. Lt. & Pwr.	6s	1945 *k*103	....
Ark. Lt. & Pwr.	6s	1954 *k*104	....
Assoc. Gas & Elec.	6s	1955 97	92½ 97½
Assoc. Gas & Elec.	6½s	1954 *k*103	....
BERLIN CITY ELEC.	6½s	1928 99½	98 100
Berlin City Elec.	6½s	1929 98½	97 98½
Binghamton Lt., Ht. & Pwr.	5s	1946 99½	98½ 100
Birmingham Elec.	6s	1954 104	102½ 104
Birmingham Ry., L. & P.	4½s	1954 92	88 92½
Broad River Power	5s	1954 92	91 92½
Broad River Pwr.	6½s	1934 101½	100 102
Brooklyn Edison	5s	1949 104½	103 105½
Brooklyn Edison	6s	1930 104½	103½ 106½
Buffalo Gen. Elec. 1st	5s	1939 102½	101½ 102½
Buffalo G. E., 1st & Ref.	5s	1939 102½	101½ 102½
Buffalo G. E.	5s	1956 103½	99½ 103½
Burlington Ry. & Lt.	5s	1932 96½	96 97½
Butte Elec. & Pwr.	5s	1951 101	100 101
CALIF. ELEC. GEN.	5s	1948 *m*101½	....
Calif. Gas & Elec.	5s	1937 102	100½ 102
Calumet Gas & Elec.	5½s	1960 102½	97½ 102½
Canadian Lt. & Pwr.	5s	1949 61	56 64
Canton Elec.	5s	1937 100½	100 101
Carolina Pwr. & Lt.	5s	1938 105	100½ 105
Carolina Pwr. & Lt.	5s	1956 *k* 99	97½ 99½
Carolina Pwr. & Lt.	6s	1953 *m*104½	104½ 105½
Cedar Rap. Mfg. & Pwr.	5s	1953 100½	99½ 101½
Central Ark. Ry. & Lt.	5s	1928 99½	99 100½
Central Ga. Pwr.	5s	1938 98	95 98½
Central Ill. Lt.	5s	1943 100½	99½ 101
Central Ill. Pub. Serv.	5s	1952 96	92 96½
Central Ill. Pub. Serv.	5½s	1950 100½	96 100½
Central Ill. Pub. Serv.	6s	1944 103	99 103½
Central Ind. Pwr.	6s	1947 99½	98 100½
Central Ia. Pwr. & Lt.	6s	1944 101	99½ 101½
Central Maine Power	5s	1939 99½	98½ 100
Central N. Y. Gas & El.	5s	1941 99	96½ 99½
Central Pwr. & Lt.	6s	1946 *m*101½	....
Central Pwr. & Lt.	6½s	1952 *k*107	....
Central States Elec.	6s	1945 95½	91 98½
Chattanooga Ry. & Lt.	5s	1956 91	81 90
Cincinnati Gas & Elec.	5s	1956 102½	102 103½
Cincinnati Gas & Elec.	5½s	1961 *k*104½	....
Cities Service	6s	1966 *k* 93½	91½ 94
Cities Service	7sB	1966 *k*195	....
Cities Service	7sC	1966 *m*129½	125½ 131
Cities Service	7sD	1966 *k*106½	101½ 106
Cities Service	7sE	1966 *k*112	....
Cities Service Pwr. & Lt.	6s	1944 *k* 95½	....
City L. & T., Sedalia, Mo	5s	1952 86	83 86½
Cleveland Elec. Illum.	5s	1939 103½	102½ 104
Cleveland Elec. Illum.	5s	1954 103½	102½ 104½
Cleveland Elec. Illum.	7s	1941 111½	110 112
Colorado Pwr.	5s	1953 95½	95½ 99½
Columbia Gas & Elec.	5s	1927 *k*100½	....
Columbia Ry. Gas & El.	5s	1936 94	92½ 95
Columbus, Dela. & Marion Elec.	5s	1937 87½	83½ 86
Columbus, Dela. & Marion Elec.	6s	1937 94½	93½ 96
Columbus Elec. & Pwr.	6s	1947 *k*104	....
Columbus Ry., Pwr. & Lt.	5s	1940 98½	97 98½
Columbus Ry., Pwr. & Lt.	6s	1941 106½	104½ 105½
Commonwealth Edison	5s	1943 104½	102 104½
Commonwealth Edison	5s	1953 103½	99½ 103½
Commonwealth Edison	5s	1954 103½	99½ 103½
Commonwealth Pwr.	5s	1939 *m* 93	....
Commonwealth Pwr.	6s	1972 *m* 97½	....
Commonwealth Pwr.	6s	1947 *k*105½	....
Community Pwr. & Lt.	6s	1950 100½	98 100½
Conn. Ry. & Ltg.	4½s	1951 91½	90 92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 82	80 82½
Consol. Elec.	5s	1955 99	98 99½
Consol. Gas of N. Y.	5½s	1945 105½	104½ 106½
Con. Gas. Elec. Lt. & Pwr. of Balti.	4½s	1935 *e* 98½	95½ 98½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 *e*107½	105½ 107½
Con. Gas. Elec. Lt. & Pwr. of Balti.	5s	1965 *e*101½	100½ 102½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5s	1952 *e*106	104½ 106
Con Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1951 *m*104½	109 109½
Consumers Elec. L. & P.	5s	1936 98½	96 98½
Consumers Pwr.	5s	1936 101½	100 101½
Consumers Pwr.	5s	1952 *k*101½	....
Consumers Pwr.	5½s	1954 104½	103½ 105
Continental Gas & Elec.	5s	1927 *k*100	....
Continental Gas & Elec.	6s	1947 *k*102½	....
Continental Gas & Elec.	6½s	1964 *k*101½	....
Continental Gas & Elec.	7s	1954 *k*112	....
Cumberland Cty. Pw. & Lt.	5s	1942 104½	94 104
DALLAS PWR. & LT.	6s	1949 105	104 105
Dayton Ltg.	5s	1937 100½	100 101
Dayton Pwr. & Lt.	5s	1941 102½	100 103
Defiance Gas & Elec.	5s	1942 98½	98 99
Denver Gas & Elec.	5s	1949 99½	98 100
Denver Gas & Elec. Lt.	5s	1951 *k* 97½	....
Des Moines Elec.	5s	1938 101	99 101
Detroit Edison	5s	1933 *k*101½	101 103½
Detroit Edison	5s	1940 102½	....
Detroit Edison	5s	1949 101½	100 104½
Detroit Edison	5s	1955 102½	102 102½
Detroit Edison	6s	1932 130	124½ 135
Detroit Edison	6s	1940 *k*107½	....
Detroit Edison	7s	1928 *m*131½	124½ 134
Detroit Edison	7s	1929 *m*131	124½ 138½
Detroit Edison	7s	1930 130½	124½ 138½
Dominion Pwr. & Trans	5s	1932 96½	95 97½
Driver-Harris	8s	1931 97½	95 98½
Dubuque Elec.	6s	1942 102½	102 103½
Duke-Price Pwr.	6s	1949*m* 107	102 106
Duke-Price Pwr.	6s	1966 *k*102½	100½ 102½
Duquesne Lt.	6s	1949 *k*105½	....
Duquesne Lt.	5½s	1949 105½	105 107
Durham Pub. Serv.	7s	1949 101½	99 101½
EAST PENN. ELEC.	6s	1953 104½	105 106
East. N. J. Pwr.	6s	1941 102½	99 103
East Oregon Lt. & Pwr.	6s	1929 100	100 101
East. Tex. Elec.	5s	1942 *k* 97	....
Economy Lt. & Pwr.	5s	1956 100½	99 101
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	99½ 100½
Edison Elec. Illum. of Bklyn.	4s	1939 95	93 99½
Edison El. Illum. (N.Y.)	5s	1995 106½	103 108½
El Paso Elec.	5s	1932 *m*102	....
El Paso Elec.	5s	1950 99½	95 99½
El. Pwr. Corp. (Germany)	6½s	1950 *k* 93	....
Elec. Refrigeration	6s	1936 104½	100½ 107
Elmira Wtr., Lt. & R.R.	5s	1956 98	96 98½
Empire Dist. Elec.	5s	1949 98	92 98
Erie Ltg.	5s	1967 100½	99 100½
Evansville G. & El. Lt.	5s	1932 99½	99 100
FEDERAL LT. & TRAC.	5s	1942 96½	92½ 97½
Federal Lt. & Trac.	6s	1942 102½	100 104½
Federal Lt. & Trac.	6s	1954 96	93 97
Florida Power & Light	5s	1954 *k* 94½	91½ 96½
Florida Publ. Service	6s	1955 96½	97 99
Florida Public Service	6½s	1949 99½	99 103
Ft. Smith Lt. & Trac.	5s	1936 *k* 81	....
Ft. Worth Pwr. & Lt.	5s	1931 100½	99 100½
GALVESTON ELEC.	5s	1940 86½	86 92
General Elec.	3½s	1942 91	87 90½
Georgia Carolina Pwr.	5s	1952 93½	87 93½
Ga. Lt., Pwr. & Rys.	5s	1941 100½	86½ 102½
Ga. Ry. & Elec.	5s	1932 99½	89 100½
Ga. Ry. & Elec.	5s	1949 97	94½ 97½
Ga. Ry. & Pwr.	5s	1954 98½	96 99
Ga. Ry. & Pwr.	6s	1947 103½	103 105
Ga. Ry. & Pwr.	7s	1941 105	105 107
German Gen. Elec.	6½s	1940 *k*108	....
German Gen. Elec.	7s	1945 *k*101	....
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 87½	85 88
Great Cons. Elec. Pwr. (Japan)	7s	1944 *k* 95	....
Great Falls Pwr.	5s	1940 102½	100½ 104½
Great Northern Pwr.	5s	1935 99½	98½ 100½
Great Western Pwr.	5s	1946 99½	98½ 100½
Great Western Pwr.	5½s	1955 100½	99 101
Great Western Pwr.	6s	1949 103½	102 104
Great Western Pwr.	6s	1952 104½	102 104½
HAMBURG ELEC.	7s	1935 99	94 99½
Havana Elec. R., Lt. & P.	5s	1954 97	92½ 99
Holtwood Pwr.	6s	1954 105	100 105½
Houston Ltg. & Pwr.	5s	1931 100½	99 101
Houston Ltg. & Pwr.	5s	1953 98½	90½ 98½
Houston Ltg. & Pwr.	5½s	1954 101½	99½ 102½
Hydraulic Pwr.	5s	1951 102½	101½ 103
Hydraulic Pwr.	5s	1950 102½	101½ 103
IDAHO PWR.	5s	1947 99½	96 99½
Ill. Elec. Pwr.	6s	1943 103½	102 103½
Ill. Pwr.	5s	1933 96	93 96
Ill. Pwr.	6s	1944 *m* 99	....
Ill. Pwr. & Lt.	5½s	1954 100½	97½ 99½
Ill. Pwr. & Lt.	6s	1953 103½	100½ 102½
Ill. Pwr. & Lt.	7s	1953 104½	102 104
Ind. Elec.	6s	1947 99	98 100
Ind. Gen. Serv.	5s	1948 99	96½ 99½
Ind. Lighting	4s	1958 85	82½ 85
Indiana & Mich. Elec.	5s	1955 98½	96 98½
Indiana & Mich. Elec.	5s	1957 100	97½ 100½
Ind. Service	5s	1950 95½	91½ 95½
Ind. Service	6s	2020 89	83 89
Ingersoll-Rand	5s	1935 101	....
International Pwr. Sec.	6½s	1955 *f*90½	....
Interstate Elec.	6s	1933 95	94 98½
Interstate Pwr.	6s	1944 *k* 99	....
Interstate Pwr.	7s	1934 *k*100	....
Interstate Pub. Serv.	6s	1948 100	98 100
Iowa Ry. & Lt.	5s	1932 99	97½ 100
Iowa Southern Utilities	5½s	1950 94½	94 96
JERSEY CENT. PWR. & LT.	5½s	1945 97½	95 98
KANSAS CITY PWR. & LT.	5s	1952 *k*102½	....
Kansas Elec. Pwr.	6s	1937 104½	100 104½
Kansas Elec. Pwr.	6s	1943 103	99½ 103½
Kansas Gas & Elec.	6s	1952 104½	101½ 106
Kansas Gas & Elec.	6s	2022 95½	92½ 96½

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Poston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, June 29. *l*Bid, low, high, Wednesday, June 30. *m*Latest quotations available. *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday June 26	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	102	99½	102½
Kentucky Utilities.....	6s	1949	102½	99½	102½
Kings Cty. Elec. L. & P..	5s	1937	103½	102	103½
Kings Cty. Elec. L. & P..	6s	1997	123½	120½	123½
Kings County Ltg.....	5s	1954	100½	98½	100½
Kings County Ltg.....	6½s	1954	109½	106	110
Knoxville Ry. & Lt.....	5s	1946	97½	95½	98
LACLEDE GAS LT.....	5s	1934	k100½	....	....
Laclede Gas Lt.....	5½s	1953	k103½	....	....
Laurentian Pwr.....	6s	1936	100½	100	101
Laurentide Pwr.....	5s	1946	100½	100	102
Lehigh Pwr. Sec.....	6s	2026	k 94½	93	95½
Lincoln Gas & Elec.....	5s	1941	94½	92½	94½
Long Island Ltg.....	5s	1936	100½	99	100½
Long Island Ltg.....	6s	1954	m102	99½	102
Long Island Ltg.....	6s	1948	108	104½	108
Los Angeles Gas & Elec..	5s	1939	k101	....	....
Los Angeles Gas & Elec..	5½s	1943	103	99	103½
Los Angeles Gas & Elec..	5½s	1947	k103	....	....
Los Angeles Gas & Elec..	5½s	1949	103	99	103½
Los Angeles Gas & Elec..	6s	1942	107	102½	107½
Louisiana Pwr.....	6s	1944	103	98½	103½
Louisville Gas & Electric..	6s	1937	101	100	102
Louisville Gas & Elec....	5s	1952	k100	....	....
Louisville Gas & Elec....	5½s	1954	104	102	104½
Lower Austrian Hydro El.	6½s	1944	k 86	....	....
Luzerne Cty. Gas & El...	5s	1948	99½	97½	99½
Luzerne Cty. Gas & El...	7s	1944	105	103½	105½
Luzerne Cty. Gas & El...	6s	1954	104½	102	105
MADISON RIV. PWR..	5s	1935	100½	100	101
Manila Elec.....	7s	1942	m114½	102	115½
Manila Elec. Ry. & Ltg..	5s	1953	95½	89½	97
Manitoba Pwr.....	5½s	1951	k 97	94½	98
Memphis Pwr. & Lt.....	5s	1948	100½	99	101½
Metropolitan Edison.....	6s	1952	k107½	....	....
Metropolitan Edison.....	5s	1953	100½	96½	101½
Metropolitan Pwr.....	6s	1953	105½	102½	105½
Michigan Lt.....	5s	1946	99½	99	100½
Michigan No. Pwr.....	5s	1941	99½	97	100
Milwaukee El. Ry. & Lt..	4½s	1931	k 98	....	....
Milwaukee El. Ry. & Lt..	5s	1951	100	98½	100½
Milwaukee El. Ry. & Lt..	5s	1961	c 96	....	....
Milwaukee El. Ry. & Lt..	6s	1953	k104½	....	....
Minn. Pwr. & Lt.....	5s	1955	98½	95½	99½
Minn. Pwr. & Lt.....	6s	1950	105½	104	106
Miss. Power.....	5s	1955	95	92	94
Miss. River Pwr.....	5s	1951	100½	99	101
Miss. River Pwr.....	7s	1935	101½	102	103
Mo. Edison Elec.....	5s	1927	m100½	100½	100½
Mo. Pwr. & Lt.....	5½s	1955	98½	96	98½
Mobile Elec.....	5s	1946	98½	97	98½
Monongahela W. Pa. Pub. Service.....	5½s	1953	97½	95	97½
Montana Pwr.....	5s	1943	k101½	....	....
Montreal Lt., Ht. & Pwr.	4½s	1932	k 97½	....	....
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½	101
Montreal Pub. Serv.....	5s	1942	94½	94	95½
Mountain States Pwr.....	6s	1938	101	98½	101
Municipal Service.....	5s	1942	93	92½	93½
NASHVILLE RY. & LT.	5s	1953	98	96½	98½
Nashville Ry. & Lt.....	5s	1958	93	90½	93
Nassau Lt. & Pwr.....	5s	1927	100	98½	100½
Nassau & Suffolk Ltg....	5s	1945	93½	89½	93
National Elec. Power.....	6s	1945	93½	92½	94
National Pwr. & Lt.....	7s	1972	k103½	....	....
National Pub. Serv.....	6½s	1955	96½	94½	97
Nebraska Pwr.....	5s	1949	102	99	103
Nebraska Pwr.....	6s	2022	99½	94½	100
Nevada-Calif. Elec.....	6s	1946	102½	98½	102½
Nevada-Calif. Elec.....	6s	1950	102½	98½	102½
New Brunswick Pwr.....	5s	1937	86	81½	86½
New England Pwr.....	5s	1951	104	100½	104½
New Jersey Pwr. & Lt....	5s	1936	98½	96½	99
New Orleans Pub. Serv..	4½s	1935	91	87	91
New Orleans Pub.Serv.,A.	5s	1952	k 95½	....	....
New Orleans Pub. Serv...	5s	1955	95½	90½	96½
New Orleans Pub. Serv...	6s	1949	93½	90	94
N.Y. & Queens El. L.&P..	5s	1930	100½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	81½	79½	82
N.Y. & Westchester Ltg..	5s	1954	99½	97½	99½
New York Edison.....	6½s	1941	k117	....	....
New York Edison.....	5s	1944	k103½	....	....
N.Y. Gas & El. L., H.&P.	5s	1948	105½	104½	105½
N.Y. Gas & El. L., H.&P.	4s	1949	91½	89½	92
N.Y. State Gas & Elec...	5½s	1962	101½	100	101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	93½	89½	91
Niagara Falls Pwr.....	5s	1932	101½	100½	103
Niagara Falls Pwr.....	6s	1932	105½	104½	106½
Niagara Falls Pwr.....	6s	1950	106	105	107
Niagara, Lock. & Ont. Pwr.	5s	1955	k100½	....	....
Niagara, Lock. & Ont. Pwr.	6s	1958	m106	....	....
Norfolk Ry. & Lt.....	5s	1949	97½	94	97
No. Amer. Edison.....	6s	1952	103½	101½	105
No. Amer. Edison.....	6½s	1948	k105½	....	....
No. Amer. Lt. & Pwr.....	7s	1954	104½	99	104½
North Caro. Pub. Serv...	5s	1934	k 96	....	....
North Caro. Pub. Serv...	6s	1954	97	94½	97
North Caro. Pub. Serv...	6½s	1944	100½	98	101
North Shore Elec.....	5s	1940	101	98½	101
No. Calif. Pwr.....	5s	1948	k100½	99½	101½
No. Ind. Gas & Elec.....	5s	1929	99½	99	100
No. Ind. Gas & Elec.....	6s	1952	104½	102½	105
Northern N. Y. Utilities..	5s	1955	98½	95	99
Northern N. Y. Utilities..	5½s	1949	101½	100	101½
No. Ohio Pwr.....	7s	1935	k 93½	....	....
No. Ohio Trac. & Lt.....	4s	1933	90½	87	91
No. Ohio Trac. & Lt.....	5s	1956	85	84	86
No. Ohio Trac. & Lt.....	6s	1926	99½	99	100
No. Ohio Trac. & Lt.....	6s	1947	97½	92½	99
No. States Pwr.....	6½s	1933	k103½	102½	104
No. States Pwr. (notes)....	6½s	1933	112½	108	131
No. States Pwr.....	6s	1948	k104	103	104½
No. States Pwr.....	6s	1941	k105½	....	....
No. States Pwr.....	5s	1941	99½	97½	101
No. Tex. Elec.....	5s	1940	68	72	75
Northwestern Elec.....	6s	1935	102½	102	103½
Northwestern Pub. Serv..	6½s	1948	101½	99½	102½
Nova Scotia Tr. & Pwr...	5s	1946	88	88	90
OHIO PWR.....	5s	1952	k 99	94	101
Ohio Pwr.....	6s	1953	105½	103½	105½
Ohio Pwr.....	6s	2024	99	95½	99
Ohio Pwr.....	7s	1951	106	105½	106½
Ohio Pub. Serv.....	5s	1954	97½	92½	97
Ohio Pub-Serv.....	6s	1953	104	101	104½
Ohio Pub. Serv.....	7½s	1946	112½	112½	113½
Ohio Pub. Serv.....	7s	1947	111	110½	112½
Ohio River Edison.....	6s	1948	k104½	....	....
Okla. Gas & Elec.....	5s	1950	95	93	95½
Okla. Gas & Elec.....	6s	1940	k 96½	....	....
Ontario Pwr. of Niagara Falls.....	5s	1943	101	99½	102½
Ontario Transmission.....	5s	1945	99½	99½	101
Ozark Pwr. & Wtr.....	5s	1952	84	77	84
PACIFIC COAST PWR..	5s	1940	101	99	101½
Pacific Gas & Elec.....	5s	1942	k100½	....	....
Pacific Gas & Elec.....	5½s	1952	k103½	....	....
Pacific Gas & Elec.....	6s	1941	k108½	....	....
Pacific Lt. & Pwr.....	5s	1942	k102	....	....
Pacific Lt. & Pwr.....	5s	1951	101½	100	101½
Pacific Pwr. & Lt.....	5s	1930	99½	99½	101
Pacific Pwr. & Lt.....	5s	1953	m 96½	....	....
Parr Shoals Pwr.....	5s	1952	97½	95	98½
Paterson & Passaic G.&E.	5s	1949	102½	100	102½
Penn Central Lt. & Pwr...	5½s	1975	97½	94½	98
Penn Central Lt. & Pwr...	6s	1953	104	102½	105
Penn Edison.....	5s	1946	99½	96½	99½
Penn. Elec.....	6s	1955	m105	92	105
Penn Elec.....	6½s	1954	m105	97	100½
Penn.-Ohio Edison.....	6s	1950	k102½	98½	106
Penn Ohio Elec.....	6½s	1938	106	105	107
Penn Ohio Pwr. & Lt....	5½s	1954	101½	98½	101½
Penn Ohio Pwr. & Lt....	6s	1939	99	97	98½
Penn Pwr. & Lt.....	5s	1952	99½	97½	100
Penn Pwr. & Lt.....	5s	1953	100	97½	100½
Penn Pwr. & Lt.....	6s	1953	105½	105	106
Penn Pwr. & Lt.....	7s	1951	106	105½	106½
Penn Pub. Serv.....	5s	1954	98½	96	98½
Penn Pub. Serv.....	6s	1947	105½	103	105
Penn Wtr. & Pwr.....	5s	1940	102½	101½	102½
Penn Wtr. & Pwr.....	5½s	1953	104½	102½	104½
Phila. Co.....	6s	1944	k104½	....	....
Phila. Co.....	5½s	1938	100½	98½	101½
Phila. Co.....	5s	1951	99½	97½	99½
Phila. Co.....	5s	1949	m104½	103½	104½
Phila. Elec.....	5s	1966	c104½	103	104½
Phila. Elec.....	4s	1966	m 88½	84	88½
Phila. Elec.....	5s	1960	102½	101½	103½
Phila. Elec.....	6s	1941	c107½	107½	108½
Phila. Elec.....	5½s	1947	c108	103½	108
Phila. Elec.....	5½s	1953	c107½	103½	108
Phila. Elec. Pwr.....	5½s	1972	c102½	100½	103
Portland Elec. Pwr.....	6s	1947	k101½	....	....
Portland Gen. Elec.....	5s	1935	101	99½	102½
Portland Ry., Lt. & Pwr..	5s	1942	k 92½	....	....
Portland Ry., Lt. & Pwr..	6s	1947	101½	99	103
Portland Ry., Lt. & Pwr..	7½s	1946	107	105½	108½
Potomac Edison.....	6s	1949	100½	99	100½
Potomac Edison.....	6½s	1948	103½	103	104
Potomac Elec. Pwr.....	5s	1929	j100	99½	100½
Potomac Elec. Pwr.....	5s	1936	j100	99½	100½
Potomac Elec. Pwr.....	6s	1953	j106	....	....
Potomac Elec. Pwr.....	7s	1941	j106	....	....
Power Corp. of N. Y.....	6s	1942	101½	101	101½
Power Corp. of N. Y.....	6½s	1942	104½	104	105½
Power Securities.....	6s	1949	m 79	....	....
Pub. Lt. & Pwr.....	5s	1945	74	68	76½
Pub. Serv. Co. of Colo....	5½s	1954	98½	95	98½
Pub. Serv. Co. of Colo....	6s	1953	101½	100	101½
Pub. Serv. Co. of Colo....	7s	1933	101½	101½	102½
Pub. Serv. Corp. of N.J..	5s	1959	m101	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	k104	....	....
Pub. Serv. Co. of No. Ill..	5s	1956	99	99	100
Pub. Serv. Co. of No. Ill..	5½s	1962	105	103½	106
Pub. Serv. Co. of No. Ill..	5½s	1964	105	103½	106
Pub. Serv. Co. of Okla....	6s	1949	102½	98½	102½
Pub. Serv. Elec. & Gas....	5½s	1959	k105	....	....
Pub. Serv. Elec. & Gas ..	5½s	1964	k104½	....	....
Pub. Util. Evansville, (Ind.)	6s	1929	100½	99½	101
Puget Sound Pwr.....	5s	1933	100½	99	101½
Puget Sound Pwr. & Lt...	5½s	1949	k101	....	....
QUEBEC PWR.....	6s	1953	103½	101½	104
Queensborough Gas & E..	5s	1952	103	99½	100½
Queensborough Gas & E..	6s	1953	105	104	105½
Quincy (Ill.) Gas, Elec. and Heat.....	5s	1935	94½	93	94½
RHINE-WESTPHALIA ELECTRIC PWR.....	7s	1950	97½	95	100
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94½	93	94½
Robbins & Myers.....	7s	1952	58	56	68½
Rochester Gas & Elec....	5½s	1948	105½	104½	106
Rochester Gas & Elec....	7s	1946	k112	....	....
Rochester Ry. & Lt.....	5s	1954	102½	100½	102½
Rockford Elec.....	5s	1939	100½	99½	100½
Rome Wire.....	6s	1940	99	98	100½
ST. MAURICE PWR...	6½s	1953	108½	108	109½
St. Paul Gas Lt.....	5s	'944	101½	100½	101½
St. Paul Gas Lt.....	5½s	1954	102½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937	95	91½	97
Salt River Valley Wtr....	6s	1938	k100	....	....
Salmon River Pwr.....	5s	1952	101½	100½	101½
San Antonio Gas & Elec...	5s	1949	97½	96	97½
San Antonio Pub. Serv...	6s	1952	105½	101½	106½
San Diego Cons. G.&E....	5s	1939	k100½	....	....
San Diego Cons.G.&E....	6s	1939	102½	101	102½
San Joaquin Lt. & Pwr...	5s	1945	101	98½	101
San Joaquin Lt. & Pwr...	6s	1950	104½	103	104½
San Joaquin Lt. & Pwr...	6s	1952	106	99½	104
San Joaquin Lt. & Pwr...	6s	1954	103½	100½	103½
Sauda Falls.....	5s	1955	96½	94	96½
Savannah Elec. & Pwr....	7½s	1941	k106½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	k 97½	....	....
Scranton Electric.....	5s	1937	102	101½	102½
Seattle Elec.....	5s	1930	100½	100½	101½
Seattle Elec.....	5s	1929	99½	99½	100½
Seattle Elec.....	5s	1939	93½	92½	94½
Seattle Ltg.....	5s	1949	94½	90½	95
Servel Corp.....	6s	1931	k109	99½	108½
Shawinigan Wtr. & Pwr..	5s	1934	k100½	....	....
Shawinigan Wtr. & Pwr..	5½s	1950	104½	103½	105
Shawinigan Wtr. & Pwr..	6s	1950	105½	104½	105½
Sheboygan Elec.....	5s	1946	97½	94½	98
Siemens & Halske.....	7s	1928	k 99½	96	100
Siemens & Halske.....	7s	1935	k 99	93	99
Sierra & San Fran. Pwr...	5s	1949	k 97½	....	....
Sierra & San Fran. Pwr...	6s	1949	k 92	....	....
Sioux City Gas & Elec....	6s	1947	103½	101½	104½
Sioux City Gas & Elec....	6s	1949	103½	102	104
So. Caro. Gas & Elec.....	6s	1942	94	78	97
So. Caro. Gas & Elec.....	6s	1932	82	70	82
Southeast Pwr. & Lt.....	6s	2025	k 94½	89	95½
So. Cal. Edison.....	5s	1939	k101½	....	....
So. Cal. Edison.....	5s	1944	k101	96½	101½
So. Cal. Edison.....	5½s	1944	104½	103	105
So. Cal. Edison.....	6s	1943	104½	102	104½
So. Cal. Edison.....	6s	1944	m105	....	....
So. Cities Utilities.....	8s	1931	m 99	99	102
Southern Colo. Power....	6s	1947	102	97½	102½
So. Ind. Gas & Elec.....	6s	1947	m 99½	....	....
Southern Pwr.....	5s	1930	100½	100	101
So. Public Utilities.....	5s	1943	101½	100	101½
So. Sierras Pwr.....	6s	1936	103½	102½	104½
So. Wisconsin Pwr.....	5s	1938	92½	91	93
Southwestern Gas & E....	5s	1932	97½	97	98½
Southwestern Gas & E....	6s	1957	97	97½	99½
Southwestern Lt. & Pwr..	6s	1937	98½	98	99½
Southwestern Power.....	6s	1944	96½	96½	98
Southwestern Pwr. & Lt..	5s	1943	97½	94	96½
Southwestern Pwr. & Lt..	6s	2022	97½	94	98
Southwestern Pub. Serv..	6s	1945	96	94	96
Southwestern Utilities....	8s	1936	110½	92½	96
Springfield Lt., Ht. & Pwr.	5s	1933	98½	99	100½
Standard Elec. of Cal....	5s	1939	100½	99½	101
Standard Gas & Elec.....	6s	1935	k100	....	....
Staten Island Edison.....	6½s	1953	106½	106	107½
Superior Water, Lt. & Pwr.	4s	1931	95	94½	95½
Syracuse Ltg.....	5s	1951	102	100	101½
Syracuse Ltg.....	5½s	1954	104½	103½	104½
TAMPA ELEC.....	5s	1933	k 99	....	....
Tenn. Elec. Pwr.....	6s	1947	k100½	....	....
Tenn. Pwr.....	5s	1962	98	96	97
Tex. Pwr. & Lt.....	5s	1937	99½	98½	100
Tex. Pwr. & Lt.....	6s	2022	99½	95½	97
Tide Water Pwr.....	6s	1942	101	100	104
Tide Water Pwr.....	7s	1937	104½	100	107
Toho Elec. Pwr. (Japan).	7s	1955	k 95½	....	....
Tokyo Elec. (Japan).....	6s	1928	k 99½	....	....
Toledo Edison.....	5s	1947	100½	100	100½
Toledo Edison.....	7s	1941	k108½	....	....
Toledo Gas, Elec. & Htg.	5s	1935	100½	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930	99½	98	99½
Topeka Edison.....	5s	1930	99½	99	100
Topeka Ry. & Lt.....	5s	1933	95½	94½	96½
Trenton Gas & Elec.....	5s	1949	102½	100½	102½
Tri-City Ry. & Lt.....	5s	1930	99½	98½	98½
Twin State Gas & Elec....	5s	1953	97	95	97
Twin State Gas & Elec....	5½s	1945	100½	98	100½
Tyrol Hydro-Elec. Pwr...	7½s	1955	k 96½	....	....
UJIGAWA ELEC PWR.	7s	1945	93	92	94
Union Elec. Lt. & Pwr....	5s	1932	101½	100½	102½
Union Elec. Lt. & Pwr....	5s	1933	101½	100½	102½
Union Elec. Lt. & Pwr....	5s	1954	100½	99½	101
Union Elec. Lt. & Pwr....	5½s	1954	100½	100½	102½
United Elec. of N.J.....	4s	1949	89	87½	89
United Elec. Lt. & Pwr...	4½s	1929	99½	98	99½
United Lt. & Pwr. (notes)	5½s	1928	99½	99	100½
United Lt. & Pwr.....	5½s	1959	98½	96	98½
United Lt. & Pwr.....	6½s	1974	98½	95½	99½
United Lt. & Rys.....	5s	1932	97	96	97½
United Lt. & Rys.....	6s	1926	99½	100	101½
United Lt. & Rys.....	6s	1952	101½	99	101½
United Lt. & Rys.....	6s	1973	93	89½	93
United Pwr. & Lt.....	6s	1944	102½	102	103½
United Water, G. & E....	5s	1941	95½	94	95
Utah Lt. & Trac.....	5s	1944	k 93	....	....
Utah Pwr. & Lt.....	5s	1944	k 98	....	....
Utah Pwr. & Lt.....	6s	1944	103	102½	104½
Utah Pwr. & Lt.....	6s	2022	98	88½	98
Utica Elec. Lt. & Pwr....	5s	1950	102½	100½	102½
Utica Gas & Elec.....	5s	1957	102½	100½	102½
Utica Gas & Elec.....	5½s	1949	104½	103½	104½
VERMONT HYDRO-ELEC.....	6s	1929	100	100	101
Vicksburg Lt. & Trac....	5s	1932	95½	93½	95½
Virginian Pwr.....	5s	1942	100	88	99
Virginian Pwr.....	6½s	1954	m103½	103	104½
Virginia Ry. & Pwr.....	5s	1934	k 99½	97½	100
Virginia-Western Pwr....	6s	1953	m105	101½	106½
WAGNER EL. MFG....	7s	....	b 99½	99½	101½
Washington Coast Util...	6s	1941	102½	102½	103½
Washington Ry. & Elec...	4s	1951	j 82½	....	....
Washington Ry. & Elec...	6s	1933	j103	....	....
Washington Wtr. Pwr....	5s	1939	102½	101½	102½
West Penn Pwr.....	5s	1963	101½	99½	103½
West Penn Pwr.....	5s	1946	102½	99½	102½
West Penn Pwr.....	5½s	1953	k105½	104½	106
West Penn Pwr.....	7s	1946	k105½	....	....
W. Va. Lt., Ht. & Pwr...	6s	1929	101½	101	102½
West Virginia Utilities....	6s	1935	99½	95½	100
W. Va. Water & Elec....	6½s	1942	m103½	102½	104
Westchester Ltg.....	5s	1950	102½	102	103½
Western Elec.....	5s	1944	101½	100½	103½
Western N. Y. Utilities...	5s	1946	98½	96½	98
Western Pwr.....	6½s	1954	101½	100	102
Western Power of Canada	5s	1949	94½	94	95½
Western Pub. Service....	6s	1950	99	98	99½
West States Gas & Elec..	5s	1941	100½	98½	101
West States G.&E. (notes)	6s	1937	94½	94½	96
West States Gas & Elec..	6s	1947	k101½	99	102
West United Gas & El....	5s	1950	102	101½	102½
Westphalia Un. Elec. Pwr	6½s	1950	k 89½	84	91
Westinghouse El. & Mfg.	7s	1931	k106	....	....
Wheeling Elec.....	5s	1941	99	99	100
Wichita R. R. & Lt.....	5s	1932	84½	83	88
Winnipeg Elec.....	6s	1954	96½	....	....
Wisconsin Elec. Pwr....	5s	1954	99½	98½	100
Wisconsin Gas & Elec....	5s	1952	100½	99½	100½
Wis.-Minn. Lt. & Pwr....	5s	1944	k 97½	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	92	94½
Wisconsin Pub. Service...	6s	1952	101½	101	102½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	94½	96½
Wis. River Pwr.....	5s	1941	95	92½	95
Wolverine Pwr.....	7s	1943	103	100	103
YADKIN RIVER PR..	5s	1941	100½	90	101
Yarmouth Lt. & Pwr.....	5s	1937	84	83	87
Yarmouth Lt & Pwr.....	8s	1951	102	99	102

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, June 29. *l*Bid, low, high, Wednesday, June 3. *m*Latest quotations available. *n*1925.

Manufacturing and Markets

Sales Steady, Outlook Good

Leaders of the Industry Report Sales in First Half of 1926 as Equal to or Better than for Same Period Last Year—Outlook for Rest of Year Favorable

WITH a sales volume during the first half of the year equal to or slightly better than for the same period last year, electrical manufacturers face the rest of the year with an optimistic outlook and a feeling that the total business for the year will be about equal to that of last year. Such is the attitude of the industry as expressed by the manufacturers approached by the ELECTRICAL WORLD and asked to put their opinions on record. Some recession has been noted in certain fields, but it is anticipated that it will only slightly affect the total sales of the year. Reports of a decreased building program indicate that the lines of industry dependent on building construction will probably be slightly affected. Central-station construction activities, which continue apace, as outlined in this issue, would show that from the central-station companies at least manufacturers can expect a business equal to or better than that from such sources for the same period last year.

Business Shows Increase—Conservative Tendency Noted

A. H. TIMMERMAN
Vice-President Wagner Electric Corporation

Incoming business for the first half of the year shows a marked increase over orders received for the corresponding period of 1925, with June the heaviest month of the year to date. Central-station business is still exceptionally heavy, and inquiries remain good. There is a tendency, however, on the part of manufacturers buying for resale and ordinarily giving releases 60 to 90 days ahead to be more conservative and specify slightly diminished schedules for the third quarter. These schedules, although smaller than for the second quarter, show a decided improvement over the third quarter of last year.

Business Better than in Any Corresponding Period

G. E. CULLINAN
Vice-President Graybar Electric Company, Inc.

Our business for the first six months of this year has been better than in any corresponding six-month period in our history. This is a showing that is particularly gratifying to us in view of the fact that it has been accomplished under our new name—Graybar. We recognize that there has been a slight slowing up in certain fields we serve. For instance, building permits have fallen off somewhat, also industry in general has not maintained the increased pace with which it started the year. However, it is our plan to cultivate actively the many markets we serve. We feel sure we can make up in certain quarters for any falling off which may develop in others, so that we believe Graybar business for the last six months of 1926 will equal the record-breaking performance of the first six months and that the period of expansion and development our company has entered into will continue right along.

Sales Equal to Those Last Year—No Marked Activity in Any Line

E. M. HERR
President Westinghouse Electric & Manufacturing Company

Our total business for the first six months of this year has been about level with the business taken during the same period last year. While our central-station business has fallen off quite materially, our orders for merchandising products have increased considerably. The industrial activity is about the same as last year, and the orders for railway apparatus have fallen off about 25 per cent. There has thus been no marked activity in any particular line. All industries seem to be purchasing in about the same volume as they did last year, although this naturally varies somewhat in different lines.

The outlook for the next six months is good. Basic conditions are stable and unless some unforeseen condition affects general business unfavorably, I believe we shall conclude the present year with a volume of sales approximately equal to that of last year.

Slightly Less Business Expected in Next Six Months

W. C. BRYANT
President Bryant Electric Company

The sales for the first six months of 1926 compared with the same period last year will in most lines be slightly lower. The first four months of the six this year were equal to or better than last in almost all of the electrical lines, but the last two months have shown a gradual recession. My opinion is that for the next six months we shall have a slightly lower volume of business than last year in the electrical industry as a whole. Certain lines will have an increase; energy consuming devices, such as electrically operated refrigerators, electric ranges, and various heating devices for household use, are more and more in demand. The lines of the industry which are affected by building will probably suffer somewhat from the reduced building program that is now indicated by reports of building contracts. Also, the coming elections this November will no doubt have some retarding effect on all lines of business, as the uncertainty of any election creates a certain amount of caution on the part of business interests.

The bright side of the matter is that there is such a large amount of money seeking investment and such low rates of interest that while, in my opinion, we shall have a recession in volume from what we have had in the last few years, nevertheless it will not be of great moment, but will have a rather healthful effect as a whole. Every indication points to a greater consumption of electrical energy in the future, and within a comparatively short time I predict that the electrical industry will be on a more stable basis of prices; but it has first got to pass through a period of adjustment, due to excess production in certain lines.

Good Volume in First Half Year—Some Slackening Expected

OTTO H. FALK
President Allis-Chalmers Manufacturing Company

We find that the volume of new business in the first half of 1926 is good, but competition is increasingly keen and has resulted in somewhat lower prices. We do not anticipate an important recession during the latter part of the year, but owing to uncertain political conditions there may be some slackening in business as compared with the first six months.

New Electric Code in Mexico

Sales of electrical supplies in Mexico have been stimulated by the issuance of a new electric code which raises the standard of permitted equipment, according to a report to the Department of Commerce. Existing installments shall be made to conform to the new code by July 11, 1926, but the Department of Industry, Commerce and Labor is authorized to extend the period if necessary. The code is an adaptation to Mexican conditions of leading codes of the United States. A number of changes from American practices are introduced, such as longer spans between poles and more lenient wiring regulations, owing to the considerable use of stone and concrete in the construction of Mexican homes. The use of cheap grades of lamp wire and sockets in Mexico is now prohibited. The smallest lamp cord permitted is to be No. 18. Mexico City and the Federal District comprise the first section to be

affected by the code, but it will be extended as rapidly as possible to other parts, the first outside areas to come under it being the states of Puebla, Vera Cruz and San Luis Potosi.

Central-Station Work Shows Unflagging Activity

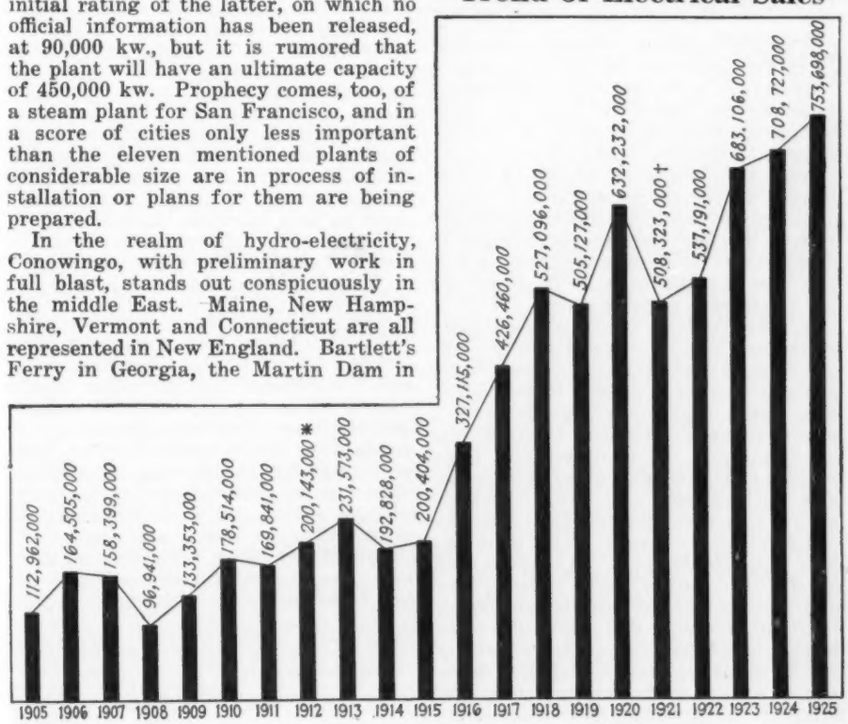
Many Projects Under Way or Projected in Every Large Industrial Center—Developments Cited

COULD a bird's-eye view be taken of electrical undertakings under way or casting their shadows before, the result would be a picture of unflagging activity now and in the immediate future in every part of the country. In the great industrial centers there would stand out conspicuously new or coming installations or additions of steam plant at the Hell Gate and East River stations in New York, Hudson Avenue in Brooklyn, Crawford Avenue in Chicago, State Line on the Illinois-Indiana border (still in the project stage), Trenton Channel in Detroit, Richmond in Philadelphia, Colfax in Pittsburgh, Avon near Cleveland and Cahokia opposite St. Louis. Add to these the Edgar station of the Boston Edison and the new Baltimore addition of the Consolidated Gas, Electric Light & Power Company and the first nine cities of the nation in population are represented. To these the Long Beach plant of the Southern California Edison Company deserves addition, as well as a contemplated steam plant to be erected by this company in Los Angeles. A California dispatch puts the probable initial rating of the latter, on which no official information has been released, at 90,000 kw., but it is rumored that the plant will have an ultimate capacity of 450,000 kw. Prophecy comes, too, of a steam plant for San Francisco, and in a score of cities only less important than the eleven mentioned plants of considerable size are in process of installation or plans for them are being prepared.

In the realm of hydro-electricity, Conowingo, with preliminary work in full blast, stands out conspicuously in the middle East. Maine, New Hampshire, Vermont and Connecticut are all represented in New England. Bartlett's Ferry in Georgia, the Martin Dam in Alabama and the Yadkin and Pigeon River plants in North Carolina are important undertakings in the South. The Chelan plant of the Washington Power Company and the never-ceasing development of Pit River in northern California and Big Creek in southern California stand out on the Pacific Coast, where also looms the great project on the Columbia River.

Florida is having an intensive development all her own involving several sizable steam plants and a transmission line to run almost the entire length of the state like a spinal cord. The building of transmission lines, indeed, goes on increasingly in every populous section. With regard to it a bird's-eye view would show countless webs, here thickly woven, there more sparse, and dwindling occasionally to mere antennas, but showing no cessation in the addition of new arcs, radii and convolutions. With the addition of every large new generator, it might be said, new transmission lines are thrown out as an almost automatic consequence. Until the day, still long distant, when the entire nation shall be covered by adjoining systems, each interconnected to its neighbors on every side, there can be no cessation in this activity.

Trend of Electrical Sales



COMBINED ELECTRICAL SALES OF ALLIS-CHALMERS MANUFACTURING COMPANY, CROCKER-WHEELER COMPANY, GENERAL ELECTRIC COMPANY, WESTERN ELECTRIC COMPANY AND WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

(a) Munitions sales during the war years and non-electrical sales not included.
(b) Western Electric sales do not include purchases from any of the above companies.

*Fort Wayne, Sprague and National added to General Electric sales.
†Southwest General Electric added and International General Electric omitted from General Electric sales.

Case of the Fractional-Horsepower Motor

Manufacturers and Central-Station Men Meet and Discuss Performance—Recommendations Made and Due Regard Given Motor Manufacturers' Problems

WITH the increasing number of motor-driven appliances which are being used in the homes of the country, the efficiency, load characteristics and general performance of the fractional-horsepower alternating-current motors commonly used to operate these devices has become a matter of much concern to central-station companies, the small-motor manufacturers and the appliance manufacturers. Considerable discussion has centered about the comparatively low efficiency and poor power factor of some types and makes of these motors, and it has appeared desirable that corrective measures be taken. At an informal conference between the Association of Edison Illuminating Companies, the National Electric Light Association and the fractional-horsepower motor manufacturers in Detroit recently, to consider the performance of fractional-horsepower motors, progress was made toward a better mutual understanding and plans were laid looking to the ultimate solution of the problems at hand.

PURPOSE OF MEETING

The purpose of the meeting, as outlined by C. F. Hirshfeld of the Detroit Edison Company, was to enable the central-station interests to discuss with the fractional-horsepower-motor manufacturers the results of some tests on small motors conducted by Prof. Benjamin F. Bailey for the Detroit Edison Company and used as a basis of a report presented by A. D. McLay at the meeting of the Association of Edison Illuminating Companies last fall. It was pointed out that these tests were not by any means inclusive or exclusive; there was no intention to praise or criticise anybody, but simply to consider the situation regarding fractional-horsepower motors as it exists and to see what, if anything, could be done to improve conditions for the benefit of all concerned. Not all of the well-known makes of small motors were included in the tests.

RESULTS OF TESTS

Professor Bailey briefly reviewed the results of the tests he conducted on ¼-hp., 1,800-r.p.m., single-phase, 60-cycle, 110-volt motors, six of which were of the split-phase type and ten of the repulsion-induction type. Based on the rule-of-thumb check in the design of induction motors, the rating of a motor is proportional to the square of the diameter of its rotor and the length of the active iron in the rotor. In the main the tests showed a difference of about two to one in the D^2L of the rotors of the largest and smallest sample of each size of motor. Such variation appeared to indicate either that the large motors had too much material or the small motors did not have sufficient material, and because of the general falling off in performance

characteristics of the smaller motors the latter might be considered nearer the true condition. It was also pointed out that so long as a motor would start and operate the load most users would pay little or no attention to the other characteristics of the motor. In the design of this type of motor there is, it seems, sometimes a tendency toward obtaining excessively high starting torque at the sacrifice of power factor and sometimes of efficiency. An example was shown of the improvement where the product of the power factor and the efficiency was increased from about 25 per cent to 40 per cent by reducing the starting torque from a value of 6 to about 3.7. Other methods of increasing efficiency and power factor and their probable cost were also discussed.

CENTRAL-STATION RECOMMENDATIONS

From a study of the complete report of the tests the representatives of the N.E.L.A. and the Association of Edison Illuminating Companies presented the following memorandum:

(a) Resolved that this group recommend to the N.E.L.A. and the A.E.I.C. that these associations develop standards for fractional-horsepower alternating-current motors requiring that the apparent efficiency (full-load efficiency multiplied by full-load power factor) be not less than 42 per cent, this standard to be based on the ¼-hp. motor and corresponding values to be developed for sizes each side of the ¼-hp. size.

(b) It is suggested to the motor manufacturers that bases of motors of different manufacture be standardized to permit changing from a motor of one make to a motor of another make on any piece of equipment.

(c) It is suggested that more attention be given to means for properly and easily oiling bearings, to providing ample bearing surface and to designing in such a way that repairs and replacements can be made more easily.

(d) Attention is called to the fact that several electricity-supply companies now have rules restricting the connection of split-phase motors to their lines and that there are indications that more companies will adopt similar policies.

(e) Attention is called to the fact that there is a demand for published performance data of fractional-horsepower motors similar to those published for larger motors.

MANUFACTURERS' PROBLEMS

The foregoing indicates in general the problems with respect to fractional-horsepower motors which it is desirable to take steps to solve. From a practical standpoint there are a number of obstacles which prevent the motor manufacturers making immediate and radical changes in the design of their product so as to meet all of the requirements indicated. The recommended apparent efficiency of 42 per cent, taken as the product of efficiency and power factor, is not difficult of attainment. There are several motors now on the market which would meet that figure. However, it was suggested by the manufacturers that this requirement should apply only to automatically controlled motors or motors running more or less steadily, as, for instance, domestic refrigerating and oil-burning motors. It would be extremely difficult to comply with this requirement if it were made to apply to intermittently operated appliances such as washing-machine motors. For such intermittent operations most appliance manufacturers use a split-phase motor in preference to the repulsion-induction motor because of the considerable price differential in favor of the former type. Aside from this consideration in designing motors to operate household appliances, manufacturers are confronted by the necessity of meeting the specifications of appliance manufacturers, which are not always compatible with increasing the efficiency and power factor of the motor. Some of the chief difficulties are:

1. Because of excessively low-voltage conditions encountered in some localities it is necessary as a factor of safety to design the motor to start under load at 85 volts and even lower.

2. High starting loads on some appliances require that motors have very high starting torque in proportion to the full-load requirements of the device.

3. Virtually all motor-driven appliances using a built-in motor require a motor designed especially for that make of appliance. For instance, no two vacuum cleaners use identically the same motor. This precludes the manufacture of an all-purpose fractional-horsepower motor.

4. Standardization of mounting dimensions is extremely difficult because of the reluctance of the appliance makers to alter the mechanical features of their devices to conform to a common method of mounting.

5. Appliance manufacturers have become accustomed to use of motors to which heretofore little or no objection had been made, and they would not readily consent to changing to a more expensive type of motor which would materially raise the retail price to the ultimate user.

6. Motor manufacturers must design a motor to perform the work required and which will operate under varying loads and circuit conditions. Frequent complaints of motor failures have been caused by low voltage or other local conditions of load which were no fault of the motor. These application problems must be met in considering the performance of motors even at some sacrifice of power factor and efficiency.

These are conditions with which the representatives both of the power companies and the motor manufacturers are confronted. It was suggested that some good could be accomplished by a rigid policing of any conditions of low voltage, and the representatives of both interests were urged to report any such conditions known to exist. It was the sense of the meeting that material improvement in the application and design of fractional-horsepower motors can be accomplished through mutual co-operation of the power companies and the motor manufacturers in pointing out to the appliance manufacturers and users the ultimate economy and advantages of using better and more efficient, even though slightly more expensive, motors. To this end it is planned to hold a series of conferences with various groups of appliance manufacturers to discuss the subject of motor characteristics.

Business Conditions

STEADY business is being transacted in the electrical industry and utility construction work continues active. Sales of line materials and switching equipment were prominent in the transactions. Industrial plants are maintaining a fair rate of buying, and the demand for small motors for domestic appliances is especially good. Although leaders in the industry anticipate a slight recession in business during the next six months present inquiries do not apparently indicate this.

In New England central-station companies are buying in good volume and the demand for line material is particularly active. Small motor sales have again reached a high level and industrial electric heating is attracting much interest. Central-station companies are buying at a good rate in the New York district and switching equipment is in active demand. In the Southeast business is steady and line materials are in demand. A number of satisfactory orders were placed for high-tension transformers for supplying distribution systems recently interconnected. Considerable building construction is noted in the Birmingham territory as well as in Atlanta and Augusta. Sales are at a better level than usual in the St. Louis district with the normal summer recession much less marked. Large dealers in industrial real estate say that there has never been a time in the history of St. Louis when there were so many inquiries from large and responsible companies for industrial sites. Utility construction work is active in the Middle West and a number of orders were placed for power plant equipment. On the Pacific Coast industrial plants, and particularly lumber mills, have been good buyers. Pumping plant and accessory sales have been about 10 to 15 per cent beyond those of any previous season.

Copper Price Decreases—Other Metals Show Little Change

Sales of copper have been unusually light and there was a corresponding easing in price, but lead has been active and the demand for the other metals can by no means be called dull. Since Monday there has been a tendency to shade the 13.875-cent delivered price of copper by one or two sellers, but others have obtained the even eighth, and one sale in the East brought 13.90 cents with 14 cents realized in the Middle West. What little demand there is seems to be for July delivery, and this is by no means plentiful.

NEW YORK METAL MARKET PRICES

	June 23, 1926 Cents per Pound	June 30, 1926 Cents per Pound
Copper, electrolytic	13.925	13.85-13.875
Lead, Am. S. & R. price	8⅛	8⅛
Antimony	11⅜	11⅜
Nickel, ingot	35	35
Zinc spots	7⅛	7.65
Tin, Straits	62	61½
Aluminum, 99 per cent.	28	28

Base copper price June 30, 1926, 16 cents.

Lead business has been excellent all week, although one producer is inclined to call the market weaker in the West the last two days. Premiums over the 8.25 cents officially quoted by the American Smelting & Refining Company have been obtained in some instances for delivery in the New York market. On the other hand, several lots of July metal were sold in St. Louis at 8.05 cents. On Saturday and Monday the zinc market developed weakness, but with improvement in the London market and a fair volume of buying on the part of domestic consumers, prices have again stiffened. Galvanizers are the principal buyers and their requirements for immediate shipment seem to be urgent. Fair activity has marked the domestic tin situation, though prices are a trifle easier.

Central Stations Buying at Good Rate in New York District

Although general central-station buying has apparently decreased slightly during the past few days, there is still a very satisfactory amount of this class of business being placed in the New York district. Switching equipment is in most active demand, with line hardware, poles and insulators maintaining a steady pace. Fewer inquiries are being received for transformers at the present time. Switching equipment orders include one for about $3,000 and one for about $50,000 worth of apparatus, together with a considerable number placed by holding companies for use on Southern properties. One order for transformers totaling 10,000 kva. is reported, although the general trend of transformer business seems to be slowing down. In the industrial field there is a steady demand for motors up to about 15 hp., and manufacturers of household oil-burning apparatus and refrigerating machines are active buyers of the smaller-sized units. Fans are somewhat active, although the weather conditions have not been such as greatly to stimulate this demand.

Utility Construction Work Active in Middle West

Continued good business is reported from most sections of the Middle West and indications are favorable for the summer months. Evidence of accumulating activity in the steel industry—the bar mills in Chicago district operating at capacity—coupled with high car loadings of all commodities, further strengthens the optimistic feeling. There is considerable construction work under way among the various utility companies consisting of additions to present plants and in extension of service lines. Interesting orders placed included one for the construction of coal bunkers and stacks valued at $60,000, and another for machinery foundations, intake and discharge tunnels approximating $175,000. Orders were also reported for apparatus, including $16,000 worth of spare turbine parts and $12,000 worth of spare boiler parts. There has been a normally good demand for pole-line hardware and insulators. Jobbers' sales are generally good, with industrial lighting sales prominent and appliances moving readily. There is an ever-increasing demand for electric refrigeration, and fan sales have been stimulated somewhat owing to warmer weather.

Sales at a Better Level than Usual in St. Louis District

Normally a depression is noted in general business during the summer season in the St. Louis district, but up to the present time this year this condition is much less marked than usual. Business is holding up at a healthy level, and although no very large orders have been reported, the general expression is that business is on an even keel. Several large dealers in industrial real estate say that in addition to the number of large manufacturing plants now under construction there has never been a time in the history of St. Louis when there were so many inquiries from large and responsible companies for industrial sites. Cool weather throughout June has caused a marked decrease in local fan business, but jobbers report continued orders received from the southwestern portion of the district.

New England Central Stations Buying in Good Volume

Linking of service lines and extensions of a number of transmission lines in the New England district have reached a point where the demand for wire, poles and line hardware is quite active. A prominent manufacturer records a steady call for insulators, and another reports heavy weekly shipments of line wire and orders in good volume for emergency stock and supplies for central-station companies. Considerable interest is noted in voltage regulators, many inquiries being received, and one order amounting to about $20,000 was closed. Industrial equipment continues in active demand and small motors again reached a high level in sales. Industrial electric heating is attracting much interest. An Eastern furnace manufacturer reports extensive plans under way in Middle West automobile plants for adoption of electric furnaces on a much wider scale than has been the practice in the past, and recently orders have been received for two new heating furnaces for Ohio plants and one from a Pennsylvania concern, all for early fall delivery. Locally industrial heating is gradually swinging over to electric furnace practice and much activity is reported throughout the southern New England section.

Electric vehicle sales recently reported include twelve baker's delivery trucks, and a number of other orders are pending. Electric welding appliances are selling well, the volume this month has been very promising and sales to date reported by one manufacturer are well over those for last year with garages showing a strong interest in buying. Household-appliance sales are fluctuating. With a falling off in the movement of minor appliance sales, but a decided improvement in the call for ranges, of which 35 were recently placed in western Massachusetts, and an active demand is recorded throughout the Southern Atlantic States. Refrigeration units are also steadily gaining in popularity.

Steady Sales in Southeast—Line Materials in Demand

Steady and satisfactory business is reported by all electrical interests throughout the Southeast. A number of very satisfactory orders were placed for large high-tension transformers for supplying distribution systems recently interconnected. One order covered about 5,000 kw. of transformers. Heavy purchases of line materials are also being made, with a satisfactory demand for insulators and switching equipment. Distribution materials for 2,300-volt service are also active, and the volume of orders for distribution transformers and house-type meters is well above normal for this period of the year.

Considerable building construction in the Birmingham territory is to be noted in both commercial and residential lines, with a resultant brisk demand for wiring supplies. The demand is also reported as good in the Atlanta and Augusta territories. Orders will be placed within the next 30 days for the electrical material for a hotel in Augusta costing about $1,000,000. A large central-station company in Georgia has announced its intention to enter the house-wiring field actively. Fans continue in brisk demand, and south Georgia centers reported stocks as completely exhausted, though new shipments are expected daily. The Norfolk & Western Railway has announced that more than $1,000,000 will be expended in the installation of automatic block signals, the construction of a 4,000-volt transmission line and the electrification of water-pumping equipment on its line between Roanoke, Va., and Winston-Salem, N. C.

Industrial Plants Active Buyers on Pacific Coast

Industrial plants continue to be active buyers on the Pacific Coast. Purchases have included five arc-welding outfits probably as the result of a campaign. Thirty-five 5-kw. distribution transformers were sold for pumping-plant service. Pumping plant and accessory sales have been about 10 to 15 per cent beyond those of any previous season.

Orders for wire and cable include one for $25,000 from the Great Northern Railway and another for $16,000 for a new lumber mill. The city of Tacoma has awarded contracts covering about $18,000 worth of substation equipment, and other power company orders have included 15,000 pin-type 10-kv. insulators, 900 20-ft. and 25-ft. poles, a carload of iron conduit and two carloads of electric ranges. A number of motor orders placed include two 150-hp. motors direct-connected to pumps for use in the Lake Chelan district, 20 units from 50 hp. down for a cold-storage plant, and a 300-hp. motor for a pumping plant at Malaga. Among the number of inquiries being received is one from a mill that calls for 30 motors ranging from 150 hp. down. The Northern Railway Company has awarded a contract for the construction of a substation at Skykomish—the first of two to be built in connection with its electrification program.

Activities of the Trade

American Brown Boveri Gets Railway Equipment Order

The Pennsylvania Railroad has placed an order with the American Brown Boveri Electric Corporation for the electrical equipment for seven electric locomotives, which it is said will be the most powerful ever built. The units will be constructed by the Pennsylvania Railroad in its shops at Altoona, Pa. Each locomotive will have four driving motors with a combined capacity of 3,640 hp., a driving axle load of 75,000 lb. and 80-in. drilving wheels. The engines will be adaptable either to high-speed passenger locomotive service or for pulling the heaviest freight. They will be able to pull 100 loaded freight cars at 35 miles per hour, or a sixteen-car Pullman train at 75 miles an hour, and operate on either alternating or direct current.

The Gibb Welding Machines Company, Bay City, Mich., manufacturer of electric arc, spot and seam welders, has started to build an addition to its factory and will more than double its present floor space.

The Thermogray Company, Jefferson, Iowa, has placed on the market a line of fully insulated automatic domestic water heaters of the storage-tank type using a low-capacity element so that the heat is applied slowly over a relatively long period.

The Graybar Electric Company announces that its Buffalo branch house has been moved to 77 Swan Street. The new quarters, consisting of offices and warehouse, contain 20,000 sq.ft. of floor space and provide larger quarters than were available at 709 Main Street, the former address. The company also announces the appointment of Chester Tappan to the carrier telephone and public address sales department of the company. Mr. Tappan was formerly connected with the research department of the Bell Telephone Laboratories, Inc.

The American Insulation Company, Roberts and Stokely Streets, Philadelphia, has acquired a tract of about 25 acres of land at St. Louis, and is said to be planning the construction of a new branch plant at this location.

The Vye-Neill Company, 199 Purchase Street, Boston, has succeeded the Vye-Smith Company of the same address, owing to the entrance of A. W. Neill into this jobbing organization. Mr. Neill was formerly on the sales staff of the Wetmore-Savage Company of Boston.

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of portable electric tools and grinders, is now offering a new ¼-in. heavy portable electric drill.

Charles C. Phelps, 473 Getty Avenue, Paterson, N. J., announces that he has been appointed metropolitan New York and northern New Jersey representative for the Uehling Instrument Company, Paterson, N. J.; the Williams Gauge Company, Pittsburgh; the Combustion Control Division of the A. W. Cash Company, Decatur, Ill., and the National Boiler Protector Company, Dayton, Ohio. Mr. Phelps still retains his former connection with the Uehling company as treasurer of that organization. Charles I. Schmid, formerly the Boston representative of the Uehling company, is associated with Mr. Phelps.

The Bakelite Corporation, New York, has taken out a permit to build a one-story addition to its plant on Grove Street, Bloomfield, N. J.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of wiring devices, has awarded a general contract for a one-story addition to its present two-story factory on Lawrence Street, including improvements in the existing structure.

Charles T. Main, mill and hydraulic engineer, announces the removal of his office from 200 to 201 Devonshire Street, Boston.

Fay, Spofford & Thorndike, consulting engineers, have moved their office from 200 Devonshire Street, Boston, to 44 School Street.

The Burndy Engineering Company, 10 East Forty-third Street, New York, manufacturer of high-tension bus fittings, announces the appointment of the H. M. Thomas Company, San Francisco, as California representative. The company states that preparations are being considered to warehouse in San Francisco the standard Burndy line of connectors for copper tubing and cable.

Harvey Hubbell, Inc., Bridgeport, Conn., manufacturer of electrical specialties, announces a new convenience outlet made of black porcelain and having a plain face.

The Frank E. Wolcott Manufacturing Company, 74 Union Place, Hartford, Conn., manufacturer of electrical appliances, has purchased the main factory of the Wiley-Bickford-Sweet Company at 80 Pliny Street and will concentrate its operations at that address.

The General Electric Company has received an order from the Bureau of Power & Light of Los Angeles, Cal., for a 33,000-hp. steam turbo-generator to be used in the standby steam generating plant it is constructing. Three high-pressure boilers have also been purchased from the C. C. Moore company.

The Quadrangle Corporation, 114 Maiden Lane, New York, has placed on the market a new tool, called the "quadrangle," for cutting outlet holes in plaster and wood in one operation. The tool, which cuts by means of four saws, can be used with an electric drill or a hand brace.

The Walter Bates Steel Corporation, Gary, Ind., announces that C. J. Walker, formerly assistant manager of the American Bridge Company's Gary plant, is now manager of the corporation; James S. Martin, formerly structural and transmission-line engineer with the Duquesne Light Company at Pittsburgh, is chief structural engineer, and E. L. Gemmill, formerly chief structural engineer of the Blaw-Knox Company at Pittsburgh, has been appointed sales manager of the tower division.

The Line Material Company, South Milwaukee, Wis., has transferred its New England headquarters from 128 Sidney Street, Cambridge, Mass., to Room 322, 10 High Street, Boston. The company's New England warehouse has also been relocated at 5 Fargo Street, South Boston. M. R. Hoffman is district sales representative.

New Equipment Available

Boiler-Feed Regulator

A boiler-feed regulator that regulates directly by the level of the water in the boiler and does not require a float, generator or thermostat has been developed by the Atlas Valve Company, 282 South Street, Newark, N. J., and is known as the "Campbell" feed-water regulator. The regulator is a simple hollow casting with an inlet, an outlet and a pressure port. The lower end of this casting extends down into the water column and is made to terminate at the point where it is desired to maintain the water level. When the water in the water column below the lower or open end of the pipe steam passes into the regulator through a very small orifice, and this drops to about 10 per cent of the boiler pressure. As soon as the water reaches the inlet of the supply pipe hot water flows into the regulator through the orifice, some of it flashes into steam, and a pressure within the regulator equal to nearly 60 per cent of the boiler pressure is created. This high pressure acts on the diaphragm of the control valve and closes the valve. In the same way when the water level falls steam once more enters the regulator, the pressure falls and the control valve opens.

Circuit-Breaker Attachment

A direct-acting time-limit attachment for use with its standard-type circuit breakers has been placed on the market by the Roller-Smith Company, 233 Broadway, New York. The delayed action of the unit is obtained through two inclined surfaces of paddles which are highly finished and accurately ground so that they seat against each other perfectly. The two paddles are mounted in a cast quadrant-shaped chamber which is filled with oil to an indicated level. Because of their inclined position it is said that the paddle surfaces are self-cleaning, thus insuring an absolute seal at all times. The attachments are secured to the outside housing of the outside poles on multipole breakers by means of two bolts.

New Trade Literature

DE-AËRATING WATER HEATER.—The Cochrane Corporation, Seventeenth Street, below Allegheny Avenue, Philadelphia, is distributing publication No. 1,425, covering the Cochrane de-aërating water heater for preventing corrosion in boilers and piping, etc., by removing dissolved air from the water. Illustrations are given showing various applications of the heater.

GEARS.—"Silent Gears of Fibroc—Their Uses and Advantages" is the title of a booklet issued by the Fibroc Insulation Company, Valparaiso, Ind., which calls attention to the advantages of the use of silent gears in industry. It contains data for calculating horsepower of spur gears, pitch-line speed, in feet per minute, and other gear data. Attention is also called to Fibroc "GR" self-lubricating gear material.

HORSEPOWER TABLES.—The Engberg's Electric & Mechanical Works, 265 Vine Street, St. Joseph, Mich., has issued bulletin No. 302-B (which is a supplement to catalog No. 302), containing horsepower tables of the Engberg vertical inclosed self-oiling engines.

POWER-FACTOR CORRECTION. — A booklet entitled "Power-Factor Correction by the Consumer," describing the experience of the American Gas & Electric Company, has been issued by the Wagner Electric Corporation, St. Louis. The booklet contains copies of correspondence between the ELECTRICAL WORLD and the American Gas & Electric Company on the subject of power factor. The tariff used by the company, which takes power factor into account, is reprinted, and definite instances are given showing how the tariff reacted on the system load in improving power factor without any loss in revenue. Various curves graphically represent the working of the tariff, and one set of curves shows the customers' yearly savings caused by improved power factor. A chapter is devoted to the cost of correcting power factor with Fynn-Weichsel motors, and another to the cost of correcting power factor with synchronous condensers.

SWITCHGEAR. — The Allis-Chalmers Manufacturing Company, Milwaukee, is distributing bulletin No. 2,085, describing the Allis-Chalmers "Reyrolle" switchgear, which is a revision of a previous bulletin on this subject. It contains a number of illustrations showing various types of the "Reyrolle" switches and calls attention to prominent points of the switchgear.

GEARS AND SPEED REDUCERS.—"Gear Problems and IXL Speed Reducers" is the title of catalog No. 200 issued by the Foote Brothers Gear & Machinery Company, 215 North Curtis Street, Chicago, covering the "IXL" speed reducer and industrial gears for every purpose. This catalog contains engineering information on speed reducers, conveying equipment, gears of all kinds, mathematical tables, and also on the design and application of modern speed-reduction units and industrial gearing of all kinds.

WIRING DEVICES.—"Weber Dependable Wiring Devices" is the title of the 1926 catalog issued by Henry D. Sears, general sales agent, 80 Boylston Street, Boston, covering the wiring devices manufactured by the Weber Electric Company, Schenectady, N. Y.

COTTON-MILL LIGHTING.—The National Lamp Works of General Electric Company, Nela Park, Cleveland, is distributing a booklet entitled "Cotton Mill Lighting," covering the artificial lighting of cotton mills. This booklet contains photographs, sketches and simple directions on the proper lighting of cotton mills.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Tallinn, Esthonia (No. 20,964), for motor-driven household appliances and heating and cooking apparatus.

An agency is desired in Sao Paulo, Brazil (No. 20,957), for household devices, such as fans, flatirons, immersion heaters, refrigerators, hot plates, grills, percolators and toasters.

An agency is desired in Montevideo, Uruguay (No. 20,908), for electric motors and insulated copper wire. Purchase is also desired (No. 20,905) for flexible steel cables.

An agency is desired in Vienna, Austria (No. 20,897) for radio sets and parts.

Purchase is desired in Milan, Italy (Nos. 20,969, 20,980, 20,970), of radio sets and parts; (No. 20,968) of enameled copper wire.

Purchase and agency are desired in Johannesburg, South Africa (No. 20,958), for X-ray apparatus.

Sole agency is desired in Buenos Aires, Argentina (No. 20,910), for all kinds of wire.

Purchase is desired in Glasgow, Scotland (No. 21,007), of electrically driven street sweepers.

An agency is desired in Calcutta, India, (No. 21,013), for electrical apparatus for hospitals, laboratories and colleges.

Purchase and agency are desired in Valparaiso, Chile (No. 21,012), for arc-lamp carbons.

Purchase and agency are desired in Prince Rupert, Canada (No. 21,015), for electric coffee percolators and floor-polishing machines.

Purchase and agency are desired in Stockholm, Sweden (No. 21,014), for floor-polishing machines and electrical household appliances.

Purchase is desired in Mittweida, Germany (No. 21,071), of small electric furnaces.

An agency is desired in Dutch East Indies (No. 21,048), for self-contained lighting plants, electric motors, radio sets and parts, wire, cables and supplies.

An agency is desired in Cape Town, South Africa (No. 21,020), for self-contained electric lighting plants and refrigerators.

An agency is desired in Bilbao, Spain (No. 21,021), for electric machinery.

Purchase is desired in Cartagena, Colombia (No. 21,032), of electric motors.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME.—The Bangor Hydro-electric Company contemplates additional hydro-electric power development, including extensions in transmission lines.

AMESBURY, MASS.—The Department of Public Utilities has granted the Amesbury Electric Light Company permission to issue 5,600 shares of capital stock (par value $15) at par, the proceeds to be used for extensions and improvements to its system.

TAUNTON, MASS.—Extensions to the municipal electric plant is under consideration.

WATERBURY, CONN.—The Connecticut Light & Power Company is purchasing property in the vicinity of Neversink pond, in New Fairfield, in anticipation of the construction of a hydro-electric plant in New Fairfield at some future time.

Middle Atlantic States

BINGHAMTON, N. Y.—An ordinance has been introduced in the City Council authorizing the installation of an ornamental lighting system on Chenango Street, from the viaduct to State Street.

HOOSICK, N. Y.—Permission has been granted the Consolidated Electric Company, Greenwich, to extend its distribution system to furnish service in the northern part of the town.

NEW YORK, N. Y.—The New York Steam Corporation has filed plans for the construction of a power plant, at 407-25 East Thirty-fifth Street, to cost about $2,500,000. Thomas E. Murray, Inc., 55 Duane Street, is engineer.

SYRACUSE, N. Y.—Bids will be received by Thomas F. Farrell, Commissioner of Canals and Waterways, Albany, until July 19, for furnishing a Diesel engine-driven centrifugal pump and Diesel engine-driven generator at the Barge Canal terminal at Syracuse. The cost is estimated at $62,000.

WESTFIELD, N. Y.—Extensions to the ornamental lighting system in the business section is under consideration by the Village Board. Later improvements to the street-lighting system in the outlying sections are contemplated.

ASBURY PARK, N. J. — The Eastern New Jersey Power & Light Company, Asbury Park, which has recently acquired the properties of the New Egypt (N. J.) Light, Heat, Power & Water Company and the Brown's Mills (N. J.) Electric Light & Power Company, contemplates improvements to the systems and extensions in its transmission lines in those districts, to cost about $50,000.

EGG HARBOR, N. J.—The Liberty Cut Glass Works, Buffalo Avenue, plans to install electric power equipment in connection with the rebuilding of its plant, recently destroyed by fire, with loss of about $250,000.

NEWARK, N. J.—Bids will be received by the Board of Education, Essex County Vocational School, 969 Broad Street, until July 6, for electrical equipment and supplies, and mechanical and miscellaneous equipment, for local schools. Robert O. Beebe is director.

PERTH AMBOY, N. J.—The Board of Aldermen is considering the installation of an electric traffic signal system at a number of street intersections throughout the city.

WHIPPANY, N. J.—The Bell Telephone Laboratories, Inc., 463 West Street, New York, has acquired a site on the Whippany River for a proposed high-power radio transmission station for experimental purposes. The project will include a power plant, steel radio towers, laboratory, etc.

CLARION, PA. — The Clarion River Power Company has applied for permission to construct two dams on the Clarion River for proposed hydro-electric developments, one dam to be located near Foxburg, and the other in the vicinity of Clarion.

ELLWOOD CITY, PA. — The Pennsylvania Power Company which is negotiating for the purchase of the systems of Mercer County Light, Heat & Power Company, Greenville, the New Castle (Pa.) Electric Company and a number of smaller plants, is planning to extend its transmission in Mercer and Lawrence Counties.

HARRISBURG, PA.—The City Council has authorized the installation of a number of new street lamps in various parts of the city, to include 600-cp., 100-cp., and 100-watt units.

LANSDALE, PA.—Bids will be received by Nelson C. B. Kriebel, secretary, Electric Light Commission, Borough Hall, until July 14, for furnishing a 600-hp. boiler and superheater, for the municipal power plant. For details see Searchlight Section.

NEW CASTLE, PA.—Bids will be received by the New Castle School District until July 13, for the installation of an emergency lighting system in the Benjamin Franklin Junior High School. The W. C. Eckles Company, Lawrence Saving & Trust Building, is architect.

PHILADELPHIA, PA.—The Philadelphia Electric Company has filed plans for an addition to its substation at Sixth and Christian Streets.

FAIRMONT, W. VA.—The Monongahela West Penn Public Service Company has applied for a franchise in Harrison County.

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing Officer, the Panama Canal, Washington, D. C., until July 6, for cable, wire, switches, panelboards, rheostats, electric light fixtures, reflectors, flashlights, etc., under (circular 1,743).

North Central States

PONTIAC, MICH. — The Oakland Motor Car Company, Division of the General Motors Corporation, Detroit, plans to build a power plant in connection with extensions to its local plant. The total cost is estimated at $5,000,000.

CINCINNATI, OHIO—The Cleveland, Cincinnati, Chicago & St. Louis Railroad Company, plans to install electric power equipment in connection with its proposed engine terminal in the Riverside district, to cost about $400,000.

CLEVELAND, OHIO. — Contracts will soon be awarded by T. D. McLaughlin and associates, 610 Savings Building, Lima, for the construction of administration and classroom building and also power plant on Green Road, for Sisters of Notre Dame, to cost about $450,000.

WELLSVILLE, OHIO.—Plans have been filed by the Ohio Power Company, Canton, for the erection of a substation on Lisbon Street.

MUNCIE, IND. — The Kuhner Packing Company is considering the installation of a refrigerating plant in the proposed addition to its works, to cost about $200,000.

DIXON, ILL. — Permission has been granted the Illinois Northern Utilities Company to erect a transmission line from the Wisconsin-Illinois state line in Roscoe Township to connect with its Belvidere transmission line.

ELMHURST, ILL.—Bids will be received by the Board of Local Improvements until July 12 for the installation of an ornamental street-lighting system. For details see Searchlight Section.

LA SALLE, ILL. — Plans for the proposed local cement plant to be built by the Central States Portland Cement Company, care of the Cowham Engineering Company, 111 West Monroe Street, Chicago, recently organized, to cost about $2,000,000, include a power plant.

ANTIGO, WIS.—Plans are under way by the Wisconsin Valley Electric Company, Wausau, to extend its transmission lines to supply electric service to Ackley and Nera and other towns in the county.

DANE, WIS.—The Wisconsin Power & Light Company, Madison, has acquired a site in Dane on which it will erect a large substation.

MENASHA, WIS.—The installation of a 600-hp. Diesel type engine and generator in the municipal electric and water plant is under consideration by the City Council. The cost is estimated at about $100,000.

WEYAUWEGA, WIS. — Plans for the construction of a power plant at the County Asylum have been approved by the County Commissioners.

WHITEWATER, WIS.—The installation or ornamental lamps on Main Street, between the Masonic Temple and Prince Street, to replace the present lamps is under consideration by the City Council.

WYOCENA, WIS.—The Wisconsin Power & Light Company, Madison, has been granted a franchise to supply electric service in Wyocena.

DAVENPORT, IOWA.—Bids will be received by F. A. Hass, city auditor, until July 6 for installing electric lamps on Second Street, between Western Avenue and Warren Street, and on Fourth Street, between Pershing Avenue and Iowa Street, to cost about $8,000. Frank Baker is electrical engineer.

EMINENCE, MO. — Preliminary plans have been prepared by the Missouri Hydro-Electric Power Company, Land Bank Building, Kansas City, Mo., for a proposed hydro-electric development on the Current River, near Eminence, where one of a series of three dams will be located. The cost of the entire project is estimated at $750,000.

TROY, MO.—The East Missouri Power Company is installing a 600-hp. Diesel engine in its power house. L. A. Nickell is secretary and treasurer.

ELLENDALE, N. D.—Bids will be received by E. A. Smith, city auditor, until July 6, for an ornamental lighting system on Main Street.

MADISON, S. D.—Bids will be received by J. W. Emberg, city auditor, until July 12 for one 600-hp. Diesel oil engine, an electric generator, a 50-kw. motor-generator exciter set, switchboard, etc. Charles A. Trimmer is engineer.

GORDON, NEB. — The citizens have voted to sell the municipal electric plant to the Nebraska Electric Power Company, Loup City. The company proposes to establish a central distributing station here and supply electricity in Rushville and Hay Springs as well as Gordon.

OSAWATOMIE, KAN.—The proposal to issue $55,000 in bonds for extensions and improvements to the municipal electric and water plant has been defeated.

SALINA, KAN.—Extension of the ornamental lighting system to the residential section of the city is under consideration by the City Commissioners.

Southern States

KINSTON, N. C.—The City Council contemplates the installation of an ornamental lighting system in the downtown district.

ALBANY, GA. — The South Georgia Power Company contemplates extending its transmission lines to Dawson, Shellman, Cuthbert and Oglethorpe.

NEWMAN, GA.—The Arnco Mills, Inc., plans to install electric power equipment in its proposed cotton mill addition, to cost about $200,000. Lockwood, Greene & Company, Atlanta, are architects and engineers.

AVON PARK, FLA.—The City Council is considering extensions in the ornamental lighting system in the business section.

CENTER HILL, FLA.—The installation of an ornamental lighting system in the downtown district is under consideration. The J. B. McCrary Company, Atlanta, Ga., is engineer.

GAINESVILLE, FLA. — Extensions and improvements to the municipal electric and water plant, to cost about $140,000, is under consideration.

HOMESTEAD, FLA.—The City Council has engaged C. W. Murray, Homestead, to prepare plans for an ornamental lighting system in the business disrtict, for which an appropriation of $57,000 has been approved.

PENSACOLA, FLA. — Plans are under way by the Gulf Power Company, a subsidiary of the Alabama Power Company, Birmingham, Ala., for the erection of a 110,000-volt transmission line from Pensacola to Flomaton, Ala.

SARASOTA, FLA.—Plans for the proposed silica brick manufacturing and clay mining plant to be erected by the West Coast Brick Company, 124 Central Avenue, in Hillsborough County, include a power plant.

VERO BEACH, FLA. — Bonds to the amount of $150,000 have been voted for extensions to the municipal electric light and water plant.

CHATTANOOGA, TENN.—Contract has been awarded by the Southern Railway Company to Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York, for the design and construction of a locomotive terminal, consisting of roundhouse, machine shop, power house and other buildings.

COWAN, TENN.—The Cumberland Portland Cement Company will install electric power equipment at its proposed new mill unit, to cost about $500,000.

JOHNSON CITY, TENN.—The Tennessee Eastern Electric Company plans to build a hydro-electric plant on the Holston River, near Johnson City, to develop 50,000 hp.

LAWRENCEBURG, TENN. — The installation of a 200-hp. oil-burning engine in the municipal electric plant is under consideration. E. P. Nixon is city engineer.

BIRMINGHAM, ALA. — The Southern Dairies Company plans to install electric power equipment in its proposed local plant, to cost about $200,000.

SYLACAUGA, ALA.—The installation of an ornamental lighting system, to consist of fifty-five units, is under consideration by the City Council.

NATCHEZ, MISS.—The City Council has contracted with the Southern Railway & Light Company for the installation of a new ornamental lighting system in the business district.

STARKVILLE, MISS.—The installation of an ornamental lighting system is under consideratio nby the City Council.

HARRISON, ARK.—Plans are being considered by the Southwest Power Company, McAlester, Okla., to extend its transmission lines to Bellefonte, Valley Springs, Western Grove and other rural communities in Boone County.

BUNKIE, LA.—Plans are being prepared by the Louisiana Ice & Utilities, Inc., a subsidiary of the Commonwealth Utilities Corporation, St. Louis, for the construction of a new electric plant at Bunkie and the erection of a high-tension transmission line to supply electricity to adjoining towns. Improvemnets are also contemplated to the ice plant.

LAKE CHARLES, LA.—Right of way for the erection of a 66,000-volt transmission line from Orange, Tex., to Lake Charles, it is reported, is being secured by Stone & Webster, Inc., 147 Milk Street, Boston.

RUSTON, LA.—Bonds to the amount of $150,000 have been voted, of which $100,000 will be used for extensions and improvements to the municipal electric plant and waterworks.

CUSHING, OKLA.—The City Council is considering issuing $12,000 in bonds for the installation of an ornamental lighting system.

LONE WOLF, OKLA.—The Southwestern Light & Power Company, Lawton, which has acquired the municipal electric plant, plans to erect a transmission line to Hobart, about 11 miles. Plans are also underway to build a transmission line 30 miles long from Hobart to Snyder.

ALBANY, TEX.—The erection of a 60,000-volt transmission line through Putnam, Moran, Albany and Throckmorton is under consideration by the West Texas Utilities Company, Abilene. Branches of the line to be extended over Shackelford and Throckmorton to supply the oil fields and other industries in that district. Extensions are being made to the local ice plant and improvements to the local headquarters of the company.

CRYSTAL CITY, TEX.—The Texas Central Power Company, San Antonio, contemplates extensions and betterments in its local electric power plant.

DALLAS, TEX.—Plans for the installation of an ornamental lighting system for the business section have been approved by the City Commissioners.

DALLAS, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 22 for remodeling two electric passenger elevators in the United States post office, court house at Dallas. For details see Searchlight Section.

Pacific and Mountain States

RAYMOND, WASH.—The County Commissioners have granted the Willapa Electric Company a franchise to erect transmission lines over a series of new county roads radiating from Raymond.

TUMWATER, WASH.—The Great Northern Railway Company plans to erect a transmission line from Gaynor to its Tumwater power plant.

BAKER, ORE. — The Eastern Oregon Light & Power Company has applied for a license to erect a transmission line within the Whitman National Forest, covering a distance of 4½ miles.

SALEM, ORE.—Plans have been filed by the Portland (Ore.) Electric Power Company for an addition to its power plant on Liberty Street, to cost about $35,000.

FRESNO, CAL.—The City Council plans to install ornamental lamps on H Street, from Tuolumne to Belmont Avenue.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Pandora Avenue from Santa Monica Boulevard to Holmby Avenue, using pressed steel standards.

RICHMOND, CAL.—The Republic Steel Package Company plans to install electric power equipment in connection with the rebuilding of its plant, recently damaged by fire with loss of about $100,000.

SANTA MARIA, CAL.—The Board of City Trustees is considering extensions in the ornamental street-lighting system.

STOCKTON, CAL.—The California Cedar Products Company plans to install electric power equipment in connection with the rebuilding of its plant, recently destroyed by fire with loss of about $200,000.

WATERMAN, CAL.—A license has been granted the Preston School of Industry, to use waters from Sutter Creek, for a proposed hydroelectric power development.

ALAMOGORDO, N. M.—Plans for the proposed large lumber mill to be erected here by George Breece, include an electric light and power plant, which will furnish light and power service in Cloudcroft, Tularosa, La Luz, Carrizozo and other points in the Tularosa Valley. Eventually the Ruidoso and other mountain resorts will be connected with the plant.

Canada

EDMONTON, ALTA.—Tenders will be received by the City Council until July 27 for a new electric generating unit for the municipal electric plant. The cost is estimated at $275,000.

FERNIE, B. C.—Plans are being considered by the East Kootenay Power Company for the construction of a 5,000-hp. auxiliary steam plant, to be located either at Fernie or Elko.

HAMILTON, ONT. — The Dominion Power & Transportation Company contemplates building a power station, to cost about $50,000.

ARUNDEL, QUE.—The Laurentide Hydroelectric Company, a subsidiary of the Quebec Southern Power Company, 180 St. James Street, Montreal, has been granted franchises in Arundel and Huberdeau.

MOOSE JAW, SASK.—Bids will be received by the City Commissioners, City Hall, until Aug. 16 for one 5,000-kw. steam turbo-generator and one surface condenser. J. D. Peters is electrical superintendent.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 1, 1926)

1,587,147. TREATMENT OF STORAGE-BATTERY GASES; J. M. Clark, Whitestone, N. Y. App. filed July 18, 1922. As on submarines.

1,587,154. SWITCH FOR ELECTRIC WATER-HEATING APPARATUS; K. F. Henneman, The Hague, Netherlands. App. filed Nov. 6, 1923. Arranged in the conduit pipe, and which switch closes by means of the water pressure an electric water-heating circuit when a dry-cock is opened.

1,587,155. ELECTRICAL APPARATUS; E. M. Honan, East Orange, N. J. App. filed June 27, 1921. Method of protecting the physical and electrical properties thereof. A method of applying protective material to electrical apparatus wherein high-melting-point materials, either molten or in solution, may be employed.

1,587,164. ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed Aug. 9, 1920.

1,587,165. SEPARABLE ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed Nov. 20, 1920.

1,587,170. ELECTROMAGNET; H. A. Maxfield, Worcester, Mass. App. filed March 16, 1922. Electromagnetic, instead of resilient means are used to counterbalance the normal magnetic pull of an electromagnet the armature of which is moved from its normal position only when the energizing current exceeds a given intensity.

1,587,303. ELECTROLYTIC COATING APPARATUS; A. H. Hart, Montclair, N. J. App. filed April 8, 1924. For covering radiator units with copper by electrodeposition before said units are assembled into a radiator.

1,587,326. STORAGE-BATTERY PLATE; O. A. Johnson and G. A. Stowasser, Minneapolis, Minn. App. filed July 14, 1923. Having rounded and tapered corners which increase the distance between the positive and negative plates at their corners.

1,587,356. BATTERY; G. H. Riebeth, Minneapolis, Minn. App. filed Oct. 29, 1921. Tubular dry battery consisting of one or more cells or battery cores incased in an insulating paper tube.

1,587,371. MOTOR-CONTROL SYSTEM; P. W. Forsberg, Schenectady, N. Y. App. filed Jan. 30, 1926. Wherein the motors operate to drive the load and also operate as generators to brake the load regeneratively when driven thereby.

1,587,425. COOLING ACCUMULATOR CELL; O. Schepp, Tokio, Japan. App. filed Sept. 11, 1925.

1,587,430. BRAKING SYSTEM; W. Seiz Baden, Switzerland. App. filed July 29, 1924. System for braking the induction motor of a speed-control aggregate wherein the motor is connected in cascade with a commutator machine and has for its object the provision of an arrangement for utilizing the commutator machine to supply the excitation of the motor during its braking period.

1,587,440. AUTOMATIC-RECLOSING-CIRCUIT-BREAKER SYSTEM; E. Taylor Chicago, Ill. App. filed July 31, 1922. In which a circuit breaker which controls the connection between two circuits is automatically reclosed after it has been open a predetermined time and the reclosing means is rendered inoperative after the circuit breaker has been automatically reclosed a number of times.

1,587,445. ELECTRIC WELDING OR RIVETING; E. Thomson, Swampscott, Mass. App. filed Oct. 25, 1924. Of metal parts in contiguity to materials or parts likely to be injured by the application of heat.

(Issued June 8, 1926)

1,587,521. LEADING-IN CONDUCTOR; J. A. Heany, New Haven, Conn. App. filed Nov. 18, 1918. For incandescent lamps.

1,587,559. ELECTRIC HEATER; L. Shuman, Spokane, Wash. App. filed July 27, 1925. Domestic, for heating rooms.

1,587,566. ELECTRIC MOTOR UNIT; H. B. Tuthill, Grand Rapids, Mich. App. filed March 29, 1926. With self-contained control unit and one in which any operation of starting the motor can be only in such a manner that the motor will turn first, at its lowest speed or rotation, being thereafter gradually stepped up by consecutive steps to different higher speeds of rotation.

1,587,640. ELECTRIC SWITCH; B. E. Getchell, Plainville, Conn. App. filed Feb. 7, 1925. Quick-break type.

1,587,645. CONTROL OF ELECTRIC MOTORS; R. Hicguet, Paris, France. App. filed March 3, 1924. Device adapted for the control of the electromagnetic change speed devices used in co-operation with electric motors and in particular with electric traction motors.

1,587,738. ELECTRIC MOTOR; H. A. Whiteside, New York, N. Y. App. filed Feb. 11, 1919. Portable motor connected to drive a tool.

1,587,748. OUTLET FITTING; R. B. Benjamin, Chicago, Ill. App. filed March 19, 1917. Whereby various electrical fixtures and devices can be interchangeably installed quickly and easily and without disturbing the wiring system.

1,587,760. ELECTRIC MOTOR; E. L. Connell, Cleveland, Ohio. App. filed July 28, 1924. Induction motor such as used in portable tools for driving drills, reamers and other implements. Having maximum torque at low speed and specifically by the use of a wound secondary with short-circuited resistance, said resistance being so arranged as to be protected against any cumulative heating effect and to protect the more delicate motor parts against heat, and at the same time avoid the use of slip rings or the necessity of a more or less permanent and separate mounting for the resistance outside of the motor.

1,587,779. METHOD OF AND MEANS FOR ATTACHING ELECTRICAL CONDUCTORS TO BRUSHES; J. F. Kerlin and W. C. Kalb, Bradford, Pa. App. filed July 8, 1921.

1,587,806. FEEDING AND ROTATING MEANS FOR ELECTRODES; H. H. Thompson, Brooklyn, N. Y. App. filed March 26, 1918. Operating with heavy currents and at high current density such as now employed in the so-called "high-intensity" flaming-arc searchlights.

1,587,837. PULL SWITCH SOCKET; C. L. Hopkins, River Forest, Ill. App. filed Sept. 7, 1920.

1,587,841. TESTING SYSTEM; O. A. Knopp, Oakland, Cal. App. filed March 16, 1925. For testing of electrical measuring apparatus, such as instrument transformers, and indicating or integrating instruments, such as wattmeters or watt-hour meters.

1,587,951. STORAGE BATTERY; N. Harrison, Milford, Conn. App. filed Feb. 14, 1923. Which may be charged in a minimum of time or discharged under maximum load without injury.

1,588,004. CONTROL SYSTEM; H. L. Blood, North Plainfield, N. J. App. filed Oct. 2, 1922. For operating machine tools and particularly to control systems for operating lathes.

1,588,084. COMBINED ELECTRIC RANGE AND WATER HEATER; P. F. Apfel, Seattle, Wash. App. filed Oct. 4, 1923.

1,588,087. WARNING DEVICE FOR USE WITH ELECTRICALLY CONTROLLED MACHINERY; A. E. Billingsley, Hadleigh, England. App. filed Aug. 7, 1925. Primarily intended for use in connection with printing machines, but is also applicable for use with textile machinery controlled by push-buttons.

1,588,120. ELECTRIC COUPLING; T. Maijgren, Rochester, N. Y. App. filed April 10, 1923. Plug-and-socket type.

1,588,122. HEATING DEVICE; H. R. Massingham, La Grange, Ill. App. filed April 4, 1924. For mercury aspirators.

1,588,129. ELECTRIC MACHINE BRAKE; W. H. Morgan, Alliance, Ohio. App. filed Oct. 6, 1922. Spring-applied and magnetically released. Self-contained brake structure to be supported upon the shaft, the rotation of which it controls. Requires no holding-down bolts or shoes on the frame of the machine and will operate to control the rotation of the shaft regardless of the direction of rotation of the latter, and in which the brake linings may be readily renewed without necessity for dismembering the whole structure. Equally effective whether the shaft be rotated in one direction or the other.

1,588,142. ANTI-FRICTION CABLE SUPPORT FOR HEAVY-DUTY POWER CABLE; F. L. Rohrbach, Spokane, Wash. App. filed July 12, 1922.

1,588,179. LEADING-IN WIRE FOR GLASS VESSELS; E. Friederich, Berlin-Charlottenburg, Germany. App. filed Aug. 30, 1921. As incandescent lamps.

1,588,183. ELECTRIC LIGHTING FIXTURE; W. B. Goddard, San Francisco, Cal. App. filed May 4, 1921. A side-wall electric light bracket with which is combined a concealed electric plug connection.

1,588,204. TRANSFORMER; H. O. Stephens and A. Palme, Pittsfield, Mass. App. filed Sept. 3, 1925. Having windings with tap connections whereby the effective number of turns may be varied to change the ratio of transformation.

1,588,210. ARC INTERRUPTER; E. Thomson Swampscott, Mass. App. filed Feb. 27, 1924. Utilizing a plurality of agencies in quenching an arc.

1,588,211. SAFETY SWITCH; O. H. Van Amburg and L. A. Kempton, Bridgeport, Conn. App. filed June 25, 1923.

1,588,239. TRAFFIC SIGNAL APPARATUS; H. G. Leach and J. S. Leach, Brooklyn, N. Y. App. filed June 7, 1924.

1,588,286. CONTROL MECHANISM; C. Weismann, Paris, France. App. filed Aug. 8, 1921. For remote control, using an escapement for constituting each of the two elementary mechanisms—that is, the transmitting mechanism and the receiving mechanism—and interconnecting the two escapements so that when one of them escapes once it cannot escape a second time without the other having in its turn also escaped once, and conversely.

1,588,287. TEMPERATURE CONTROLLED, TEMPERATURE INDICATING AND TIME-DURATION-INDICATING DEVICE. App. filed Aug. 21, 1922. For ice-cream-freezing machinery.

1,588,359. DOUBLE-THROW SWITCH; G. L. Hammann, Torrington, Conn. App. filed July 18, 1925. Operating mechanism embodying spring means operative at either side of a dead-center position to either hold the switch closed or rapidly complete opening thereof, after initial starting toward open position, and also embodying bumper means for checking the parts when the switch has been thrown to its open position by the first-named spring means.

1,588,377. SAFETY-SWITCH MECHANISM; J. R. Kelley, Covington, Ky. App. filed June 2, 1921. Adapted to preclude initial overloading of a motor.

1,588,398. ROTARY TRANSFORMER; T. F. Barton, Schenectady, N. Y. Synchronous converter arranged to prevent the speed of the converter from increasing to a value sufficient to effect the disconnection of the converter from the direct-current circuit when the converter is operating underexcited and is disconnected from the alternating-current circuit.

(Issued June 15, 1926)

16,363 (reissue). VACUUM-TYPE INVERTED CONVERTER; L. W. Chubb, Swissvale, Pa. App. filed Nov. 29, 1915.

1,588,412. ELECTROMAGNETIC CONTROL DEVICE; J. H. Hankey, Hagerstown, Md. App. filed Jan. 7, 1926. In which the mechanical force which may be developed is relatively large for low power consumption for producing pull over a relatively short stroke with substantially no time lag and having the initial mechanical force gradually decreasing in proportion to the length of the stroke.

1,588,467. SWITCH; A. M. Pruitt, Cleveland, Ohio. App. filed May 1, 1922. Burglar-alarm type.

1,588,502. STORAGE-BATTERY CONSTRUCTION; A. M. Small, Middletown, Ohio. App. filed Oct. 3, 1924.

1,588,512. ELECTRICAL COIL; W. M. Austin, Swissvale, Pa. App. filed Sept. 19, 1922. An element for a composite electric coil, such as the field winding of a direct-current machine, comprising a strip of metal, a loop formed intermediate to the ends of said metal strip and extending in approximately the plane of said metal strip, the metal at the overlapping portion of said loop being displaced under pressure.

1,588,514. ELECTRICAL SYSTEM; A. P. Ball, Royal Oak, Mich. App. filed Aug. 1, 1918. Meter-testing system where meter-testing connections may be made and circuits established without momentarily interrupting the customer's load.

1,588,515. SWITCH; E. R. Garany, Brooklyn, N. Y. App. filed Dec. 10, 1924. For flashlights, etc.

1,588,520. ELECTRIC FURNACE; E. J. Brannigan, Buffalo, N. Y. App. filed April 29, 1924. Electric resistance furnace having carbonaceous heating units.

1,588,525. ELECTRICAL MEASURING INSTRUMENT; L. W. Chubb, Edgewood Park, Pa. App. filed Sept. 12, 1921. Thermocouple measuring devices. Means for neutralizing the differences of potential in a thermocouple caused by inaccuracy in the relation between the couple and a heater therefor, and means for neutralizing the differences of potential in a thermocouple incident to alternating-current traversing portions thereof.

1,588,530. MULTIPLE COOKING MACHINE; C. N. Currier and M. C. Merrill, Salem, Mass. App. filed April 13, 1925. To cook or toast articles of food such as sausages and to rotate each article on a vertical axis and in operative proximity to heating means constituting an element of the machine.

Directory of Electrical Associations

Printed in the first Issue of Each Volume

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Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

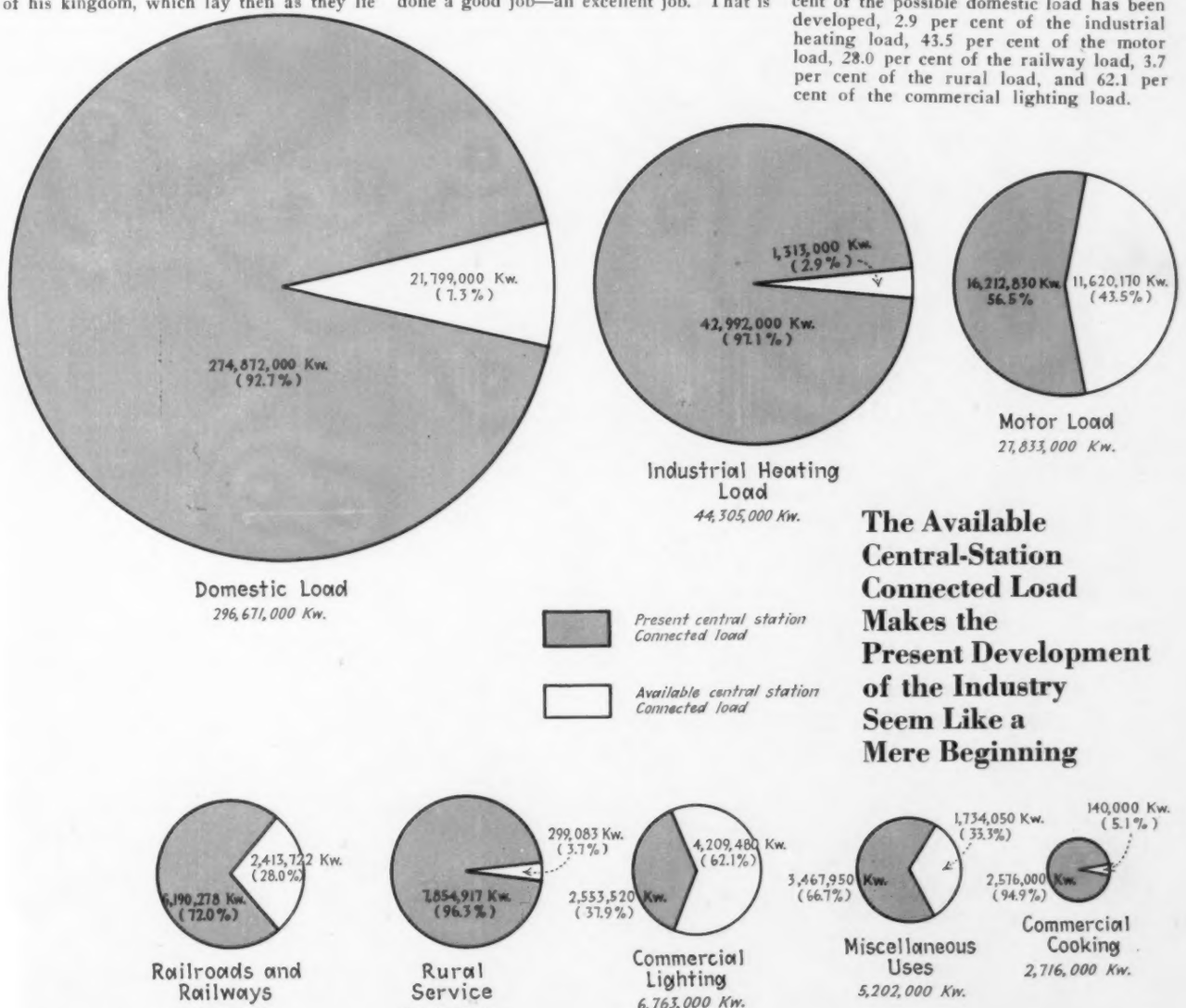
A Job Far from Completed

TRADITION tells us that after having conquered the Eastern world Alexander the Great bemoaned the fact that there remained no other country against which he might lead his mighty armies. To his way of thinking he had turned out a complete job, the only remaining task being one of unifying his empire through the strengthening of trade routes, organized local government and the encouragement of intermarriage. If, however, one were to push aside Alexander's glittering army of hundreds of thousands of men and peer into the economic and social conditions of the peoples making up his empire, he would find that this greatest conqueror of all times had totally failed to grasp the responsibilities of a king and emperor, neglecting entirely the development of the essentialities of his kingdom, which lay then as they lie now in the wellbeing of the common people. History presents few better examples of a big job uncompleted.

We have in America today another Alexander the Great typified in the electric light and power industry. Here is an industry which has conquered every form of American life—the home, the factory, transportation, mining, the farm, commerce, and the night life of our cities, towns and villages. Today we hear the belief expressed that the industry has reached its peak of growth and that from now on the growth of the electric light and power industry will parallel that of other primary industries, such as the iron and steel—Alexander crying for more worlds to conquer, believing his job completed.

The electric light and power industry has done a good job—an excellent job. That is conceded by even elementary students of the industry. But it is is a job far from completed; in fact, it is doubtful if it is 10 per cent completed. A careful study of the central-station load potentialities as they exist at the present time makes ludicrous any assertion that the industry has reached its peak of operations. The surface has just been scratched, opening up to the fuller view the rich ore in the form of possible connected load which lies just under the surface.

The present national connected load of the electric light and power companies is estimated at 43,529,000 kw., with a total maximum demand of 16,000,000 kw., an annual consumption of 48,000,000,000 kw.-hr. and a revenue to the central-station companies of $1,484,000,000. All the earmarks of a big job completed—until the size of the present possible or potential load of the nation is presented. Only 7.3 per cent of the possible domestic load has been developed, 2.9 per cent of the industrial heating load, 43.5 per cent of the motor load, 28.0 per cent of the railway load, 3.7 per cent of the rural load, and 62.1 per cent of the commercial lighting load.



Industrial Prosperity Prevalent in New England

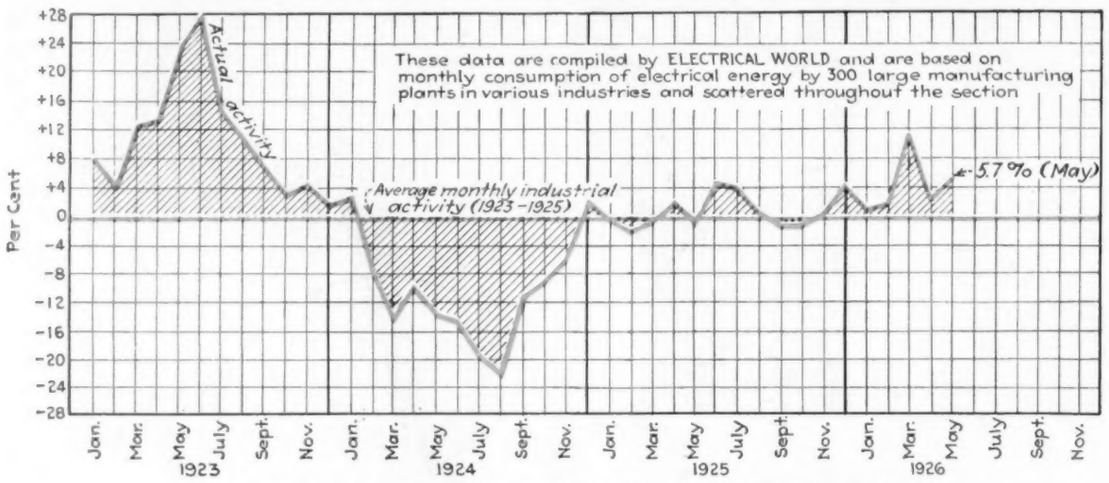
THE first half of 1926 has witnessed a high rate of activity in the manufacturing plants of New England. All of the leading industries of the section, with the exception of leather-working plants, reported activities throughout the six months' period materially above the average monthly operations for the past three years. New England industry is on its feet in a way not witnessed since the boom of 1923. Such is the picture of industrial activity in the New England States painted by the ELECTRICAL WORLD and based upon the monthly electrical energy consumption of about 300 large manufacturing plants in various industries and scattered throughout the section.

While general industry in the New England States has been operating since the opening of the year above the average for the past three years, yet this activity has not been of as high an order as was recorded by general industry in the country as a whole during the same period. Some of the leading industries of the section, such as textiles and paper, have recorded operations above those of the nation as a whole, but the leather industry with its subnormal activity has tended to hold down the general activity of the section. The peak of industrial activity was reported in March, during which month general industrial activity in New England was 11.1 per cent above the average monthly for the past three years, this figure having been corrected for seasonal variation and weighted in accordance with the importance of the various industries. The prosperous condition of New England industry during the past six months is even more clearly indicated when the fact is included that in the month of March last year general industry in the section was operating at 0.3 per cent below the average monthly activity for the past three years.

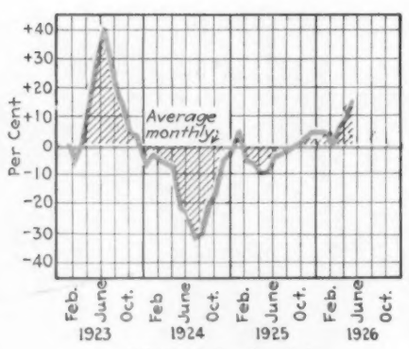
Textiles, the backbone of New England industry, opened the year with a slump in operations. March energy consumption, however, indicated operations materially above the monthly average, and this abnormal activity was maintained during April and May. Since a weight of 44.2 per cent has been given to the textile industry, the activities of that industry in New England determine the activities of general industry in the section to a very large degree. Activities in the metal industry of New England since the opening of the year have been consistently above the monthly average.

This prosperous condition of New England industry spells large industrial energy sales by central-station companies. It is a reflection of the prosperity prevalent throughout the electric light and power industry of New England.

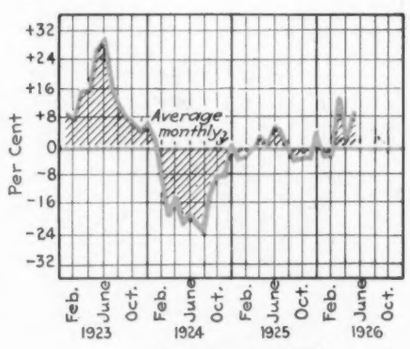
"Electrical World" Barometer of Industrial Activity in New England States



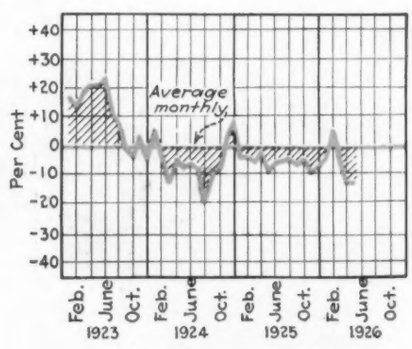
General Industrial Activity in the New England States



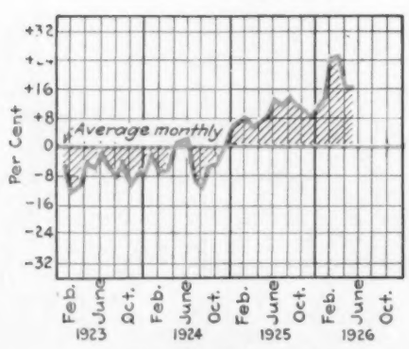
Metal Industries



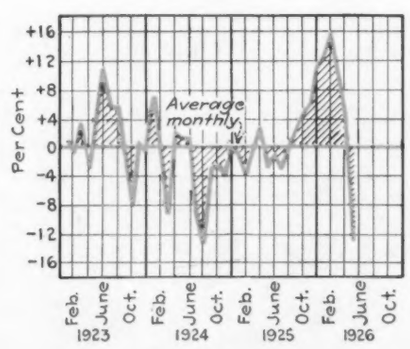
Textiles Industry



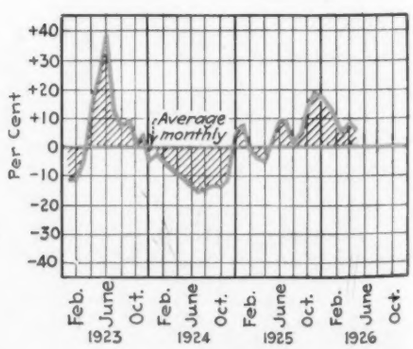
Leather Industry



Chemicals Industry



Paper Industry



Rubber